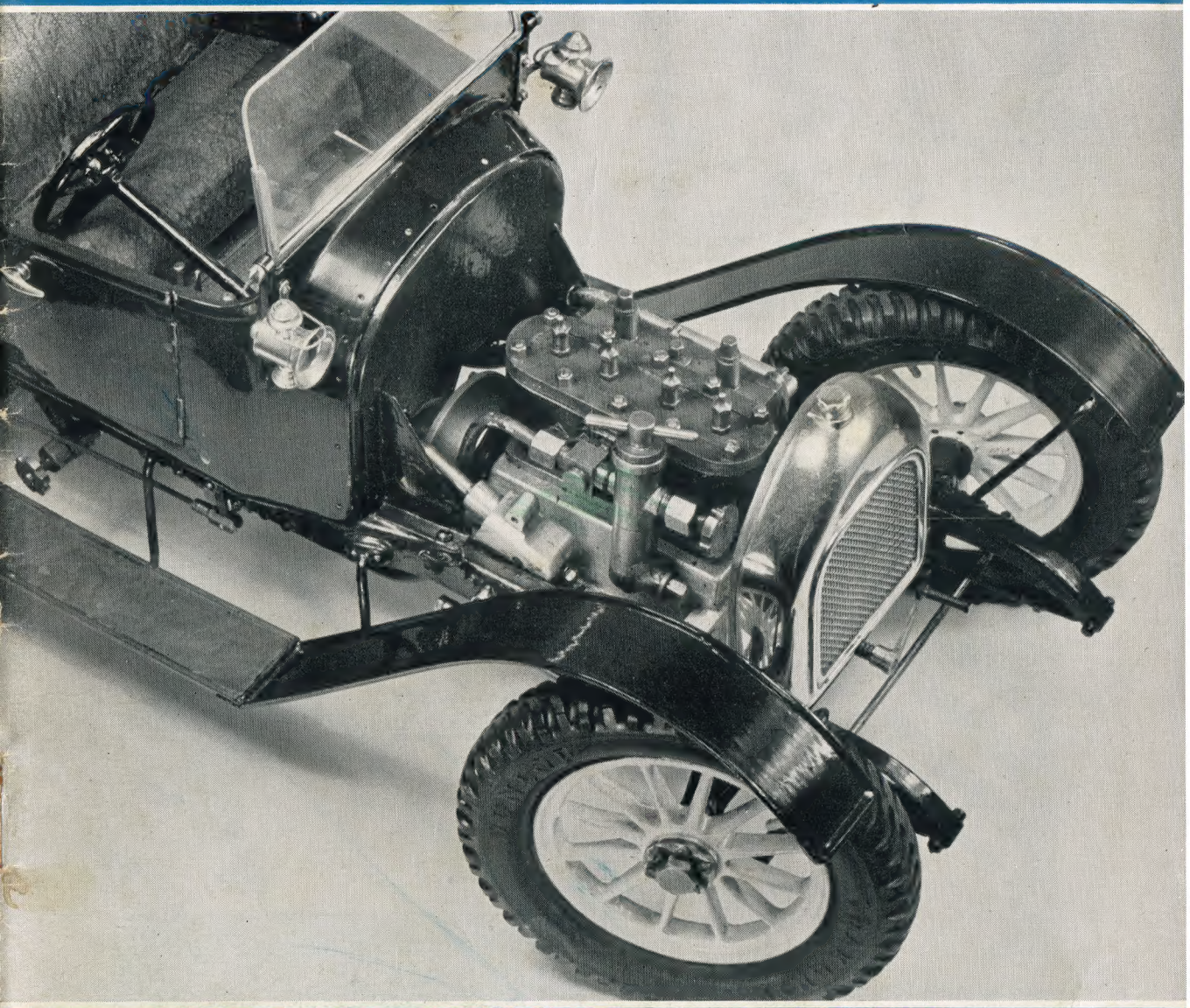
THE MODEL ENGINEER



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L.B.S.C.'s LOBBY CHAT — SUPERHEATERS • TRADE TOPICS

APRIL 15th 1954
Vol. 110 No. 2760

9D

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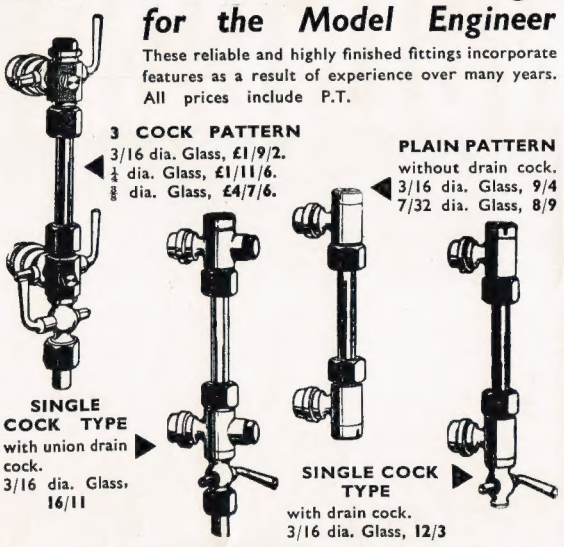

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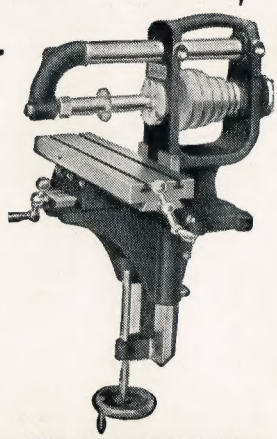

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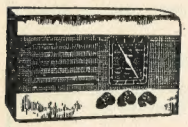

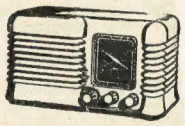

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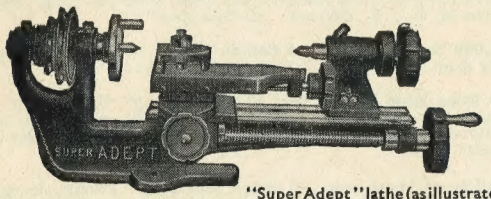

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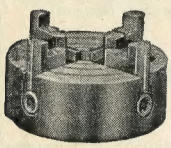

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1/8"	4d.	each	3/8"	2/1	each
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5/32"	5d.	each	13/32"	2/5	each
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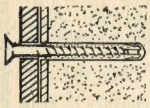

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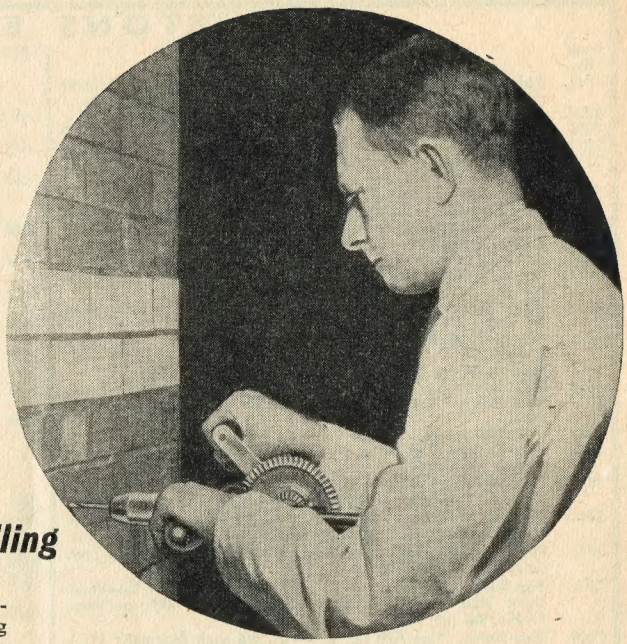

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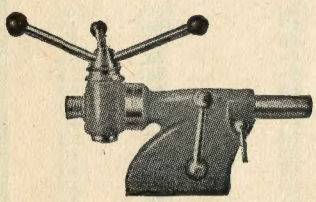

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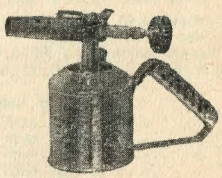

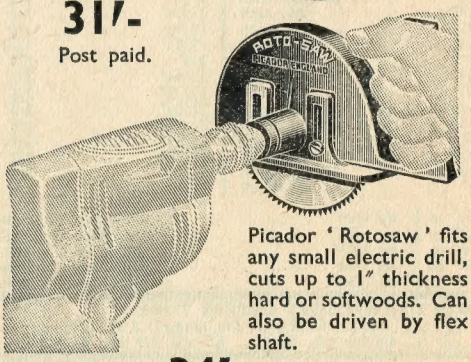

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THE
MODEL ENGINEER

EVERY THURSDAY

Volume 110 - No. 2760

APRIL 15th - 1954

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Our Cover Picture

The model car shown in this photograph is of special interest, not only on account of the general accuracy of its external appearance, and the amount of detail work in the visible accessories, but also because of its ingenious motive power, which consists of a four-cylinder steam engine, complete with a water-tube boiler and six-wick spirit lamp. Realism is enhanced by making the engine resemble as nearly as possible in external appearance the four-cylinder petrol engine of a car; the boiler and burner are housed in the back of the car, the fuel tank of the latter being in the position normally occupied by the petrol tank in this type of vehicle. A working gearbox, giving three forward speeds and reverse, is fitted, together with a cone-type clutch, also brakes, steering gear and other controls. The model represents a Humber car of about 35 years ago, to a scale of 1½" to the foot, and was brought to our notice by Mr. S. F. du Pille, of Richmond; the constructor was the late Mr. Blomquist.

SMOKE RINGS

The North Light

A LETTER from a reader, not long ago, made us wonder how many people, when planning a workshop, give consideration to the question of lighting it. Years ago, there was quite a lot of correspondence in our pages on this subject, but it was remarkable to note how little attention was given to the quality of daylight. Most people appear to imagine that daylight is provided by nature, and there is little that can be done about it; artificial lighting is more tractable, and can be very easily arranged to suit the individual requirements of any particular shop —or so it seems to be thought.

But is this not a fallacy? Surely, daylight, so long as it lasts, is the best of all lights; its only faults are that it is apt to vary considerably in intensity and, for many of us, it does not last long enough. There is, however, a means of obtaining the best out of whatever daylight there may be; this brings us back to the letter we have mentioned. Our correspondent stated that he can use his lathe only in the evenings and on Saturday afternoons, and he is, therefore, compelled to use artificial light except on spring or autumn afternoons; in summer, the afternoon daylight is very good, but in the evenings he is dazzled by the sun, because his workshop faces west. We suggested that, if at all possible he should change to a north light. He was able to do so, and duly moved his lathe to the north window; he then wrote happily to say that he finds he can now make use of at least 70 per cent. of all the daylight available to him; and it is surprisingly constant too.

A Jubilee Honour

THE BOLTON and District Society of Model Engineers has honoured its President, Mr. T. P. Longworth, by making him its first honorary life member. He is well known, especially in Lancashire, as one of the old school of craftsmen, and has been making models over a period exceeding half a century. It was on March 20th, 1905, that Mr. Longworth won THE MODEL ENGINEER Locomotive Building Competition, the first of its kind ever held; his entry like all the others, was built to the design published in our issue of January 7th, 1904, and as far back as that, the judges commended Mr. Longworth for having made his locomotive, except for a few fittings, entirely in all its details, including all the patterns required; the latter were exhibited with the engine. The award was a silver medal. Mr. Longworth has won many awards for his work, the latest occasion being in 1951, when he secured the "Hays" trophy of the Bolton society.

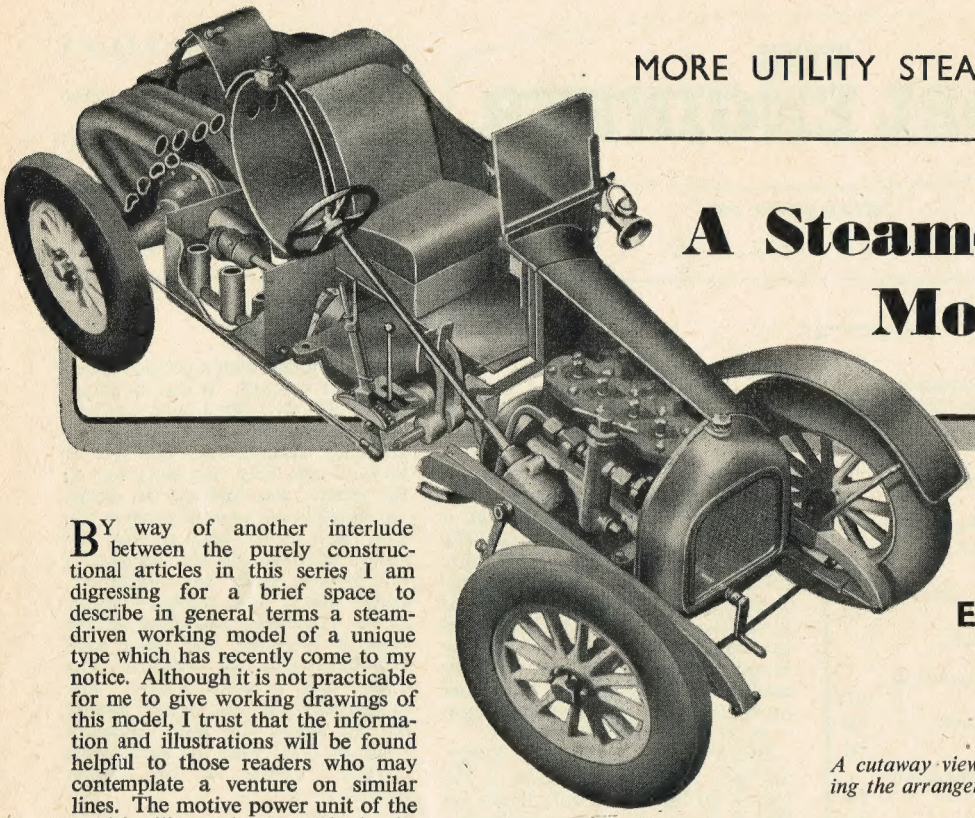
A Test of Endurance

ON MAY 22nd next, Mr. J. I. Austen-Walton, driving his 5-in. gauge 4-6-0 locomotive *Centaur*, at the Beechurst track of the Sussex Miniature Locomotive Society, will be making an attempt to achieve a 100-mile non-stop run. This will involve continuous driving for about 11 hours, assuming that speed can be kept up to an average of about 10 m.p.h.; in itself, and provided that the desired result can be achieved, this run will certainly test the endurance of the engine, the track and the driver. On 5-in. gauge, a speed of 10 m.p.h. represents about 125 scale miles per hour, and the distance to be covered is the equivalent of about 1,200 scale miles.

The longest non-stop run that a full-size steam locomotive has been called upon to make is the 401-mile Euston-Glasgow run, and this often entailed a stop at Carlisle (Kingmoor) "for locomotive purposes," sometimes involving a change of engines. The 5-in. gauge *Centaur*, therefore, will be required to run, in proportion, a distance three times longer than from Euston to Glasgow at a speed averaging more than twice that of the full-size engine.

A Steam-Driven Model Car

By
Edgar T. Westbury



A cutaway view of the model, showing the arrangement of working parts

BY way of another interlude between the purely constructional articles in this series I am digressing for a brief space to describe in general terms a steam-driven working model of a unique type which has recently come to my notice. Although it is not practicable for me to give working drawings of this model, I trust that the information and illustrations will be found helpful to those readers who may contemplate a venture on similar lines. The motive power unit of the model will certainly qualify for its classification as a " Utility " steam engine in the best sense of the term, and no apologies, therefore, should be necessary for including it in this series.

It is a rather remarkable fact that although model cars have achieved a widespread and rapidly-growing popularity in recent years, their development has, generally speaking, been confined to well-defined and somewhat restricted lines, and there have been few attempts to exploit to the full the possibilities for mechanical design and experiment which are opened up by this type of model. We have seen many models in which the the accent has been on correct external scale appearance, sometimes with purely dummy internal fittings, and controls which reproduce in some degree their proper functions; on the other hand, we have seen racing models in various classified types and sizes, in which performance is phenomenal, but few, if any, holds are barred in respect of appearance or mechanical design in the efforts to obtain it. While in no way deprecating the merits of either type of model, I would very much like to see a more adventurous spirit in design, apart from either super-accuracy in scale detail or squeezing the last ounce of performance from the engine; as I have so often pointed out, it is the mechanical *interest* in models which keeps model engineering alive, rather than the ultimate performance or scale accuracy of the models produced.

In the early days of model car development, I often discussed with fellow-enthusiasts the possibilities of trying out other means of motive power than the lively though somewhat monotonous two-stroke engine, but my overtures in this direction were not received with any warmth. The idea of using steam engines for this purpose did not appeal even to those who already had some experience with flash-steam plants in model boats, but I have by no means abandoned my convictions as to its practicability, though fully admitting that it is not without serious practical problems. These, however, apply chiefly to high-performance racing engines, and where the main object is flexibility and control, the advantages of the steam plant are too well known to call for further comment.

The model under discussion, however, is not a product of the post-war craze in model car development; it dates from a much earlier era, before attention had been focussed on this type of model, and very few model cars of any kind had been built. It was constructed by the late Mr. Blomquist, whose name may be remembered by older readers as a prolific and versatile model craftsman, in that period of lull between two world storms which some refer to as " the good old days " and others as " the age of decadence," according to their political convictions. The present owners of the model acquired it from Mr. Blomquist's son, and have renovated it with detail improvements to the power plant, so that it is now quite a handsome and indeed unique working model.

I have referred to it as a " steam-driven model car " rather than as " a model steam car," as it is not built on the lines of any full-size steam car, but reproduces with fair accuracy the appearance of a well-known petrol-driven car, namely the Humber, of 1919-20 vintage. It may be mentioned that one or two of the experts have questioned the precise accuracy of certain details of its appearance, so I will anticipate any possible argument on this matter by saying that if such is the case, there is a very good excuse for it in

a model that is obviously intended primarily for working efficiently. Constructors of working models of all types find it extremely difficult, if not impossible, to keep scale accuracy compatible with complete and efficient working details.

The car is built to a scale of 1½ in. to the foot, having an overall length of 20½ in. and width of 7 in., with a wheelbase of 15 in. and a track width of 6 in. (all dimensions approximate). Chassis details are remarkably complete and accurate, including suspension details, with quarter-elliptic laminated springs, and working shackles throughout. Steering is of the correct Ackermann type, with stub axles and kingpins, controlled from the steering wheel by a worm-and-nut type gearbox, with drop arm, drag link and track-rod. Brakes of the internal-expanding type are fitted to the rear wheels and are operated by a ratchet hand lever, through drop arms and rods.

Engine

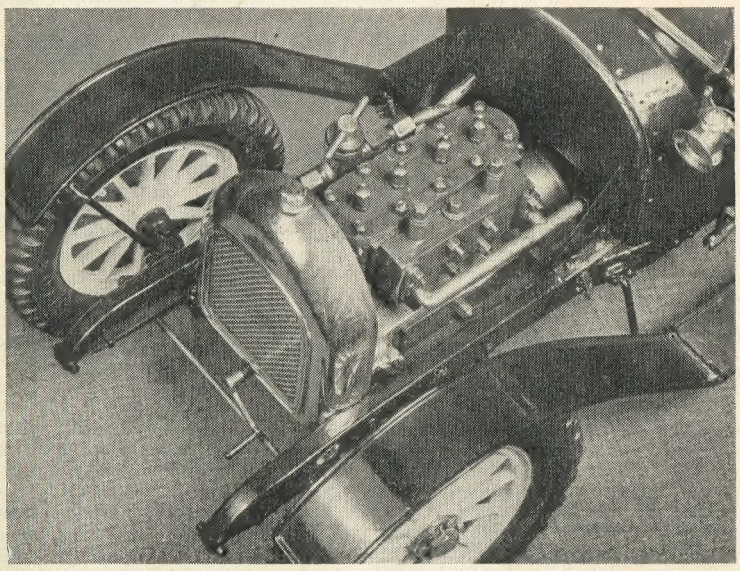
This is ingeniously contrived to look as much like a petrol engine as possible, consistent with working efficiently as a steam engine. It has four cylinders, ⅜ in. bore by $\frac{9}{16}$ in. stroke, arranged in line to operate on a four-throw crankshaft, and steam distribution is controlled by two slide-valves operated from a spur-geared side shaft, which is the equivalent of the normal camshaft. The details of the crankcase, oil sump, timing case, etc., are correctly reproduced, and dummy sparking plugs are fitted; the cylinder head is detachable.

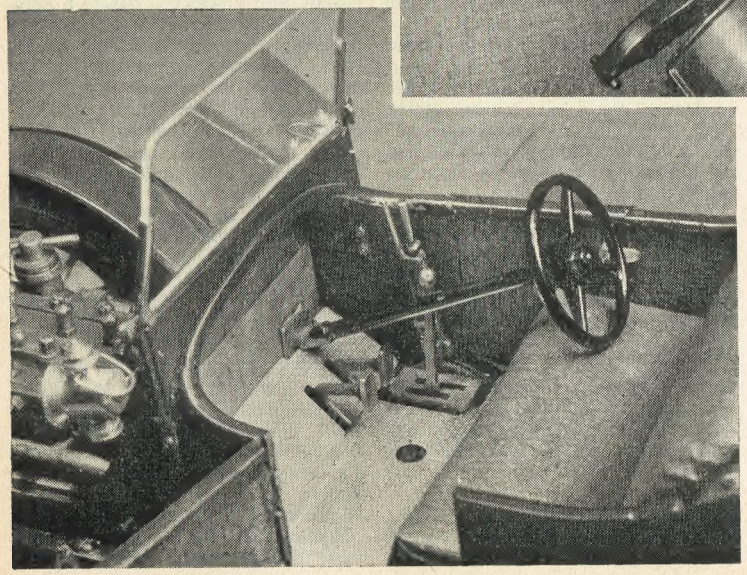
The flywheel incorporates a cone-type clutch, capable of being disengaged by means of a pedal in the normal way, but in place of the accelerator pedal, which of course would be inoperable in a model, the engine is controlled by a screw-down stop valve behind the offside running board. A displacement lubricator is fitted to a tee-piece in the pipeline, close to the engine. The exhaust is led into a manifold on the near side, and thence to a pipe which passes to the rear end of the car, as can be seen in the underside view.

Boiler

A water-tube boiler, with looped tubes connected to a transverse drum, is located behind the driving seat, in what would be known, in this class of car, as the "dicky seat." It is fired by means of a six-wick spirit lamp, fed from a fuel tank located crosswise at the back of the car, between the dumb-irons, as in full-size practice. As the usual arrangement of uptake and chimney cannot be permitted, the fumes are allowed to escape through a hinged trap door, a stay being provided to enable the door to be elevated to the most suitable angle to deflect the gases and avoid back pressure.

It may be remarked that the screws which hold the rear casing in position are rather conspicuous, but it is obviously necessary to have means of ready access to the boiler from the top. As a matter of fact, accommodation for the boiler and its appurtenances is one of the most serious problems in steam car design, large and small, and the particular limitations of space and shape in this case have certainly not reduced

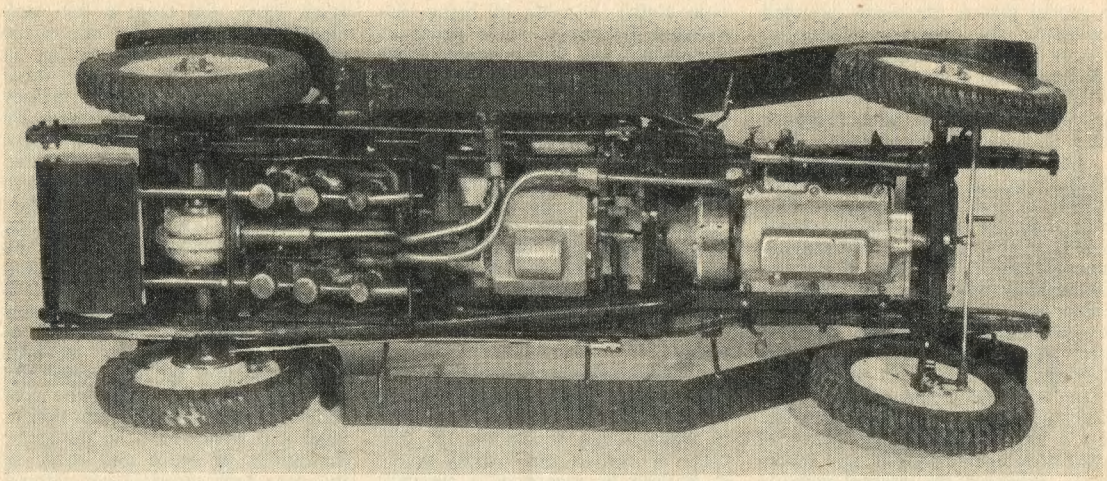




(Above). Front end view, with bonnet removed to show engine
(Left). The driver's seat, showing working controls

difficulties in this respect. A safety valve is fitted to the filler cap on the boiler drum, and can be seen projecting above the casing immediately behind the seat squab.

Another problem which besets the steam-car designer is provision for water supply, and in any car intended to steam continuously for long journeys, it is necessary either to carry a fairly large quantity of water in reserve, or provide for conservation of water by condensing exhaust steam. It is well known that the early steam cars required frequent replenishment of the water tanks,



Underside view, showing arrangement of working parts

but in the later ones, a great deal of research work was devoted to the design of suitable condensers; there was, however, always some difficulty in dealing with the amount of steam used by the engine at full power. Normal running conditions, however, rarely allowed of using full power, so the condensing arrangements generally proved adequate.

In the model there are neither reserve feed tanks nor condensing arrangements, so that only relatively short runs are practicable, but this probably suffices for the purposes for which it is intended. No feed pump is fitted, and the water supply is, therefore, limited to what can be put into the boiler drum at one filling. If I were building a model steam plant for a car, I should certainly incorporate an engine-driven feed pump, and it would not be difficult to accommodate it, with a geared drive from the engine; accommodation for reserve-water tanks could probably be found without affecting the external appearance of the car body.

Transmission

A fully working gearbox is fitted, providing three forward speeds and reverse, operated by a gate change gear lever on the right of the driver, in accordance with contemporary practice. This transmits the drive, through the usual transmission shaft, to an enclosed bevel reduction gearing incorporating a differential gear. It would appear that this part of the mechanism encounters pretty high temperature on account of the proximity of the spirit burners, but here again, space limitations permit no alternative arrangement.

For the rest, the photographs show, better than any written description, how conscientiously the detail work on all parts of the mechanism, controls and bodywork has been carried out, even down to the details of the oil headlamps, which despite their inadequacy, even in those days of relatively low road speeds, survived tenaciously against the incursion of highly efficient acetylene and electric headlamps.

For the facilities for making a complete examination of this model, I am indebted to Mr. S. F. du Pille, of Richmond, Surrey, who has also been responsible for its renovation, including complete overhaul of the engine, re-timing and re-setting valve-gear, fitting additional boiler tubes, polishing and lacquering metal fittings, etc., and finally finishing the bodywork in deep coach green cellulose. The boiler has not been fired since this work has been done, as the heat would be liable to damage the finish, but the engine runs efficiently on compressed air, and at 40 lb. per sq. in., the road wheels cannot be held by hand on bottom gear.

The model is available for inspection at Messrs. Cherry's (Surrey) Ltd., at 62, Sheen Road, Richmond, Surrey, and anyone who is interested in models of any kind will find it well worth a careful examination. But, personally, I hope that still more will come of it than this, and that many model engineers, inspired by the enterprise and diligent effort which has been devoted to this truly unique model, will be moved to " go and do likewise."

Full-size Steam Cars

While dealing with this model, I may observe that many readers have written to me on the subject of full-size steam cars, and I have been urged to produce and publish a design for a steam plant suitable for this purpose. My reluctance to do so is not due to any lack of enthusiasm for such a project, but because in order to ensure that a design would be successful, it would be necessary to carry out a good deal of practical development work on a scale to which neither my workshop equipment nor my resources are equal. It would be relatively easy to make drawings which would look very neat and plausible, but I know from bitter experience that there is a good deal more in it than that, unless one is content to tread the well-beaten track of conventional design, and produce a design a long way after something that Stanley did in 1901. It surely is hardly worth while to embark on any such enterprise unless one intends to produce something definitely new and improved; and this cannot be done without practical research.

In the past I have often worked on tentative designs in co-operation with other steam-car enthusiasts, but so far practical results are negative. I am an honorary member of the British Light Steam Power Society, which is devoting considerable attention to steam car development, and I follow all its activities with the keenest interest.

If I may be allowed to say so without hurting anyone's feelings, I think that the steam car is one of those subjects on which there is far too much talking and too little action. It is not enough to bask in the reflected glory of past steam car achievements—the fact that Serpollet held the land speed record in 1902

at 75.06 miles per hour, and that this was raised to 121.57 miles per hour by Marriott in a Stanley car in 1906, was marvellous at the time, but has been left far behind now. Neither does it help to harp on invidious comparisons between steam and internal combustion—whenever I hear the old story that " any engine which proceeds by a series of explosions is inherentlyunsuited to traction purposes " it makes me see red, considering the thousands of them that have been doing it for years ! " Yes, but they are bound to hammer themselves to pieces *in time* ! "—and that reminds me of the confirmed toper who, when told that alcohol was slow poison, replied: " But I'm not in a hurry !"

Lest readers may think that I am out to disparage the steam car, or discourage anyone from experimenting with it, I would say that I am quite convinced that it is possible to produce a steam plant in the home workshop which is not only efficient and reliable, but also much simpler to handle than the normal petrol engine in a car. But don't let us delude ourselves that it is a walk-over; even Abner Doble himself, who evolved the nearest approach to the ideal steam car that has ever been seen, admitted that to compete on all-round terms with the modern petrol car, a steam car would have to be " darned good ! "

It is often claimed that steam cars were handicapped and practically forced off the road by unfair discrimination in respect of taxation and racing classification, but I have not been able to find evidence of this, and I would very much like to hear chapter and verse from those who *are* in the know. Modern taxation laws certainly favour the steam car, but insurance is a horse of a different colour, and may present difficulties; although *we* know full well that flash boilers are as safe as the Bank of England, the insurance companies remain stolidly cautious about them !

In the little handbook " Steam Road Vehicles," compiled by the Science Museum, and published by H.M. Stationery Office (which I recommend all steam car enthusiasts to read), an impartial survey is given of the progress of steam passenger carriages from their very earliest beginnings, and no hint is given that unfair discrimination had any influence on their ultimate decline. On the other hand, the following passage is illuminating:

" In the Paris-Rouen road-race of 1894, a De Dion-Bouton steam vehicle came in first, but in the next year, in a longer race between Paris and Bordeaux, steam vehicles were so badly beaten that it seemed obvious that the petrol-engined vehicle would be more successful as a light mechanical conveyance for use on the road." Considering that at that time the steam engine had nearly 100 years start in development, its eclipse at this stage seems very surprising and disappointing.

Potentially, there is no doubt, whatever, that the steam engine is almost ideally adapted to the particular duties of road transport; in practice, however, its full capabilities have never yet been properly exploited. Whether they ever will depends on the skill and resolution with which the many detail problems in their application to these duties are tackled. To the many readers who seem keen on improving the steam car, and who have reminded me of its past successes, I would quote the old but very up-to-date saying: " Hats off to the past—but coats off to the future ! "

(To be continued)

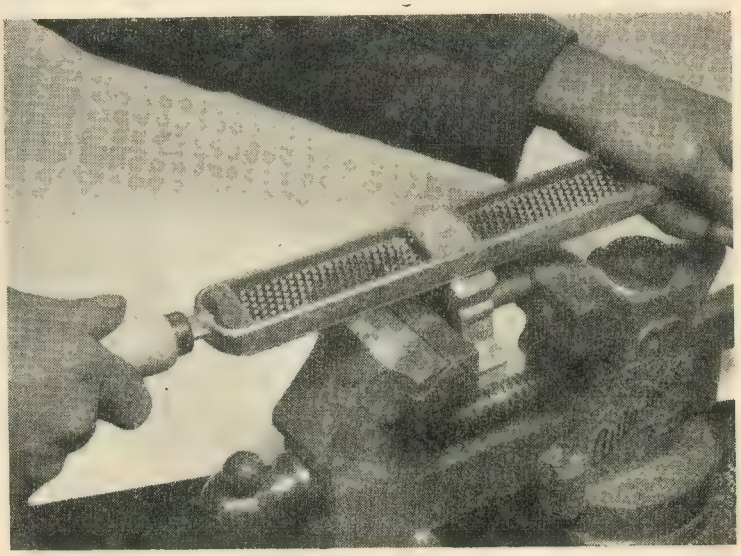
Trade Topics

Surform Tools

We have recently had an opportunity of testing out the new Surform tools introduced by Simmonds Aerocessories Ltd., Treforest, Glamorgan. These combine the principles of the file and the plane in a single tool, which is equally effective on a wide range of materials. The cutting element consists of a strip of tempered tool steel, which is furnished with obliquely cut teeth, and is also perforated to allow the escape of chips and swarf; this is secured to the underside of a light alloy holder, and tensioned by means of a screw at the front end.

Two types of holders are available, one of which resembles a normal file, and is handled in the same way; the other has a vertical hand grip at the rear end and a steady knob at the front, similar to a carpenter's plane. Both types have a wide range of usefulness, but the latter is the better suited for heavy and continuous work on hard or soft wood, and the former for light general work on non-ferrous metals, plastics, etc. Much will depend, however, on the class of tool to which the operator is normally accustomed. The blades used are the same in each case, and are readily renewable at a price which compares favourably with that of an ordinary file or rasp.

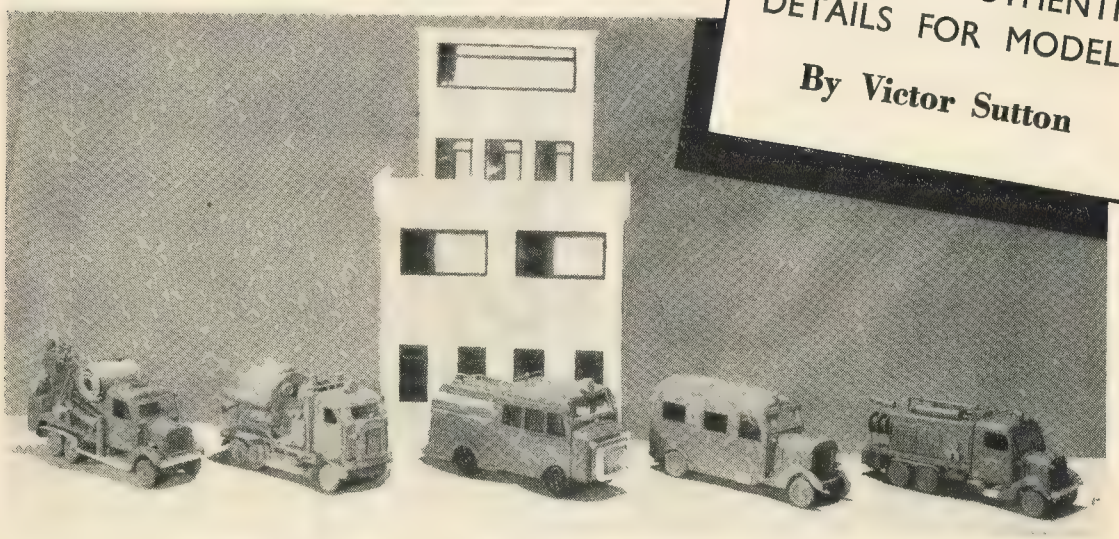
We have tried out these tools on various materials, including aluminium castings, and find that they cut efficiently with light downward pressure, and are absolutely non-clogging by reason of the perforated blade. An incidental feature is that they tend to cleanliness and tidiness in use, as the cuttings, instead of being widely scattered over the bench or floor, are retained in the trough of the holder. Whether one wishes to carry out a simple domestic job, such as easing a door or window, or shape and fit component parts of models or patterns, these tools will be found extremely useful.



Research is Half the Battle

FINDING AUTHENTIC DETAILS FOR MODELS

By Victor Sutton



Crash and fire tenders which are based on the control tower during flying operations

MY miniature-model fire brigade has now reached a total of 70 appliances. It covers the whole period of development of the fire service from 1663 to 1953. Last year it was shown at 15 exhibitions and from letters I still receive, it apparently created considerable interest. As it also includes all those queer "make-do" fire appliances of the Blitz period I suppose it may be the only set of its type in this country, and I am still building. My second cavalcade of models consists of 35 vehicles representing all those used on our aerodromes during World War II.

Whenever and wherever I show, I always meet many model makers and generally speaking they all ask the same question: "Where do you get all the detail from?" It is on the assumption that this is a stumbling block that I am basing this article. But first and foremost, I must emphasise that there is no easy way of acquiring this essential knowledge. Anyone who is interested in a series (and my two sets have been a spare-time hobby for over 20 years) should start now and make the research work also a hobby. I can assure readers that it can be just as interesting as making the models. Looking for ideas, seeking people who might be making the real thing, getting interviews, browsing over leaflets and even the thought of the postman calling with fresh material, can be quite stimulating. Reading this material alone is at least a diversion from reading one's normal journals and papers.

In the case of the aerodrome vehicles, this series started with just three models to go on my aerodrome. These were a light Dennis fire-engine, a foam tender and the interesting long 60-footer known as "The Queen Mary." Visiting an aerodrome I got the idea that there was a wealth of model-making material in a set of these vehicles. I learned that many of these types were made according to the aircraft in use at a particular period. It was also interesting to find that so many vehicles, probably because of the existence of the large staff of technicians on the station, were made up to suit special types of fire and accident risk. Thus there was far more variety in half-a-dozen vehicles than one could ever hope to see on any road. On the bomber station, for example, there was a deluge foam-unit working with a mounted 30 ft. fire tower and a separate unit for carrying water. This would probably be separate from the usual group of more normal fire appliances.

Having built a few of these I was then stuck, to a certain degree, for material. I therefore wrote to some of the well-known motor distributors, after getting addresses from a local garage owner who had plenty of books and journals complete with all the names of the makers. All my letters explained what I was making and included a stamped addressed envelope. Practically in every case I had a very polite letter and a collection of literature and some really good photographs. Further, two firms told me to which branch of the Royal Air Force I could apply for details of the Fire and Crash Section. It was only then that I learned that such a branch existed, and I should not have known otherwise. Here again, I had a very nice letter and photographs of most of the known fire and crash vehicles. The officer in his reply indicated that I would find some very interesting material in a journal such as *The Fire Protection Review*. He was quite right, and I purchased a copy of this journal. From this I found at least five firms who specialised in vehicles all built for the Royal Air Force and on aerodromes.

The reader will see from this that it was a matter of "build-up" in getting information, and had I not started at the beginning I would not have got together the material and the considerable reserve of knowledge I have now acquired. I now have all those vehicles which cover the war period and can, at my own

leisure add some of the new ones. It will also be realised that here again, as in the fire brigade models, I have almost the complete story and I do still pick up photographs of vehicles which help to fill in the gaps in the record of old-timers. Strange as it may seem, most of the vehicles still on the airfields are those used during the war period.

I consider that the ardent model maker should cultivate his powers of observation far more than he does, and the building of a series of models such as this can do much to make him more sure of himself and certain that he has got things right. In some of my models I show the yellow circle prominently displayed on the cabin roof, top of bowser or container, in the case of foam tenders. This is not on all vehicles because it was only shown on those which would normally use the perimeter track. It may not sound important, but model makers looking at the work of other model-makers might soon spot such an omission and query it. One has to know all the answers. The same applies to colours, and on some airfields the vehicles were in grey, and I did find some in olive green but never, during the war, did I see one in red. As my series belongs to that period it remains in the shades of the time—another source of friendly argument at various exhibitions.

Wheels and Tyres

Not only this, but the style of the vehicle may be guided by the job it has to do. Even the wheels on certain vehicles may look somewhat oversize, and of a very heavy specification with very deep-tread tyres. This is explained by the fact that such vehicles may have to pull aircraft while operating on soft grass and the aircraft may have lost its "under-cart," anyway. Hence, to be correct, these vehicles require towing hooks.

At the moment, the range is quite representative and comprises the following: Foam emergency tender, Carmichael heavy rescue tenders (3), remote control van, articulated flat platform lorry, fire tender with tower, articulated well-type 60-footer, heavy deluge pump and foam tender, "Queen Mary" articulated lorry, light foam tender, very heavy foam and deluge unit, general service van, utility truck, large and small ambulances, oil bowsers (4 varieties), Chance light for landing, foam tankers (2), Coles heavy crane, heavy bowsers (2), oil trailer, oil tanker, radar van, Dennis light fire engine, Merryweather light pump, rescue lorry, tractors (3).

Such a collection of small models needs good representation at exhibitions. This I arrange by making a background in short sections of about 18 in. representing a wall and covered with Modelcraft paper. Small doorways for the vehicles enable them to be lined up and look as though they are really on active service. I have also added a model control tower as a set-piece because I noticed that during flying operations all crash, fire and ambulance vehicles were based closely on this point. Here again, it is a small item of interest, but there is less chance of being tripped-up if one displays the models in a realistic fashion.

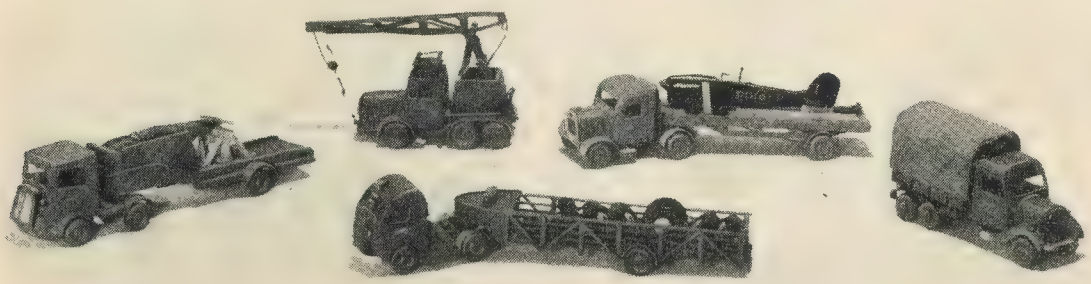
To hold a reputation as a model maker, one must be correct and to do that it is necessary to seek the authentic version and check it with people who ought to know. My vehicles on the airfield have no white-painted edges to their running-boards, or white-tipped mudguards. Such treatment is not necessary because seldom, if ever, would the bulk of them be on any road at night-time during the war.

I have only dealt with a specialised set of one type of vehicle and in this I can find far more interest than most people imagine; and I know that when I show it at any large or small exhibition I shall not have much competition.

Helpful Exhibitions

If in any doubt on any point raised at an exhibition I write to the Royal Air Force, and have the difficulty cleared up. Sometimes one is referred to the appliance builder, who usually replies and puts one right. Once more, it is the query that starts the new line of exploration, particularly when an industrialist's headed notepaper describes what he builds, and this has occurred with me many times. What is picked up at shows, the people one meets and writes to, the journals one reads, etc., often serve as sources of authentic details, and to this range I can even add local and county papers. New equipment on an airfield is news and is reported as such, but what interests me is "would it be a good model to make?" I like to know why it was made, what it was made for, and why that particular shape, colour or vintage, and in finding this out I mostly get a range of further types.

Such detail, for model makers, is not easy to come by, because it is not possible to go to a museum and seek it. If one chooses to make a series of model vehicles, the mere note of the name on a particular vehicle may be a good starting point. One can also look in any good trade directory at the library and find details of the makers of vehicles. Very often it is possible to find one firm making a whole range, and this limits fact-finding troubles considerably.



Three types of articulated lorries, Coles heavy crane and general service waggon

IN THE WORKSHOP
BY DUPLEX

Constructing an Engraving Machine

THE pantograph frame is mounted on a split bracket, *Ag* clamped to the column of the machine by two ¼-in. B.S.F. Allen cap-screws. The third 2-B.A., screw shown in the drawing is fitted for the purpose of expanding the bracket, so that its position on the column can be easily adjusted.

The projecting portion of the bracket carries a bushing, Fig. 9, internally coned at either end; this bush is also secured in place by the two bracket clamp-screws. The pivot spindle fitted to the bush is formed with a coned foot-bearing and, at its upper end, carries a second cone and a locking collar. In this way, the spindle can be adjusted to turn freely and without shake in the column bracket. The sliding box-clamp, *Ah*, is designed to grip the pantograph frame and, at the same time, it affords a mounting for the pivot spindle, which screws into its upper surface. The box-clamp slides on the limb of the pantograph frame for adjusting the setting of the machine, in order to alter the size of the lettering reproduced from the guide plate.

Continued from page 354 *April* 1, 1954.

After an adjustment of this kind has been made, the box-clamp is secured in position by tightening the 2-B.A. clamp-screw against the inset gib strip; as shown, this gib strip is fitted with a guide pin at either end. This completes the mounting of the pantograph and, after the pivots have been adjusted, the frame should move freely in all directions in the horizontal plane.

The tracing table *Bd* is mounted on the machine column by means of the two paired bracket plates, *Ba*.

These plates are slit with a sawcut so that they can be closed on the column by a clamp-screw; in addition, each is drilled and tapped for the attachment of the next part, the footing *Bb*.

The purpose of the $\frac{5}{16}$-in. B.S.F. holes shown will be evident later. To ensure uniformity, these holes and the bolting faces should be machined with the two parts clamped to a short length of $1\frac{1}{8}$ in. diameter rod. The baseplate or footing, *Bb*, is secured to the paired brackets and carries the tracing table arm, *Bc*. This tubular arm is fitted with a

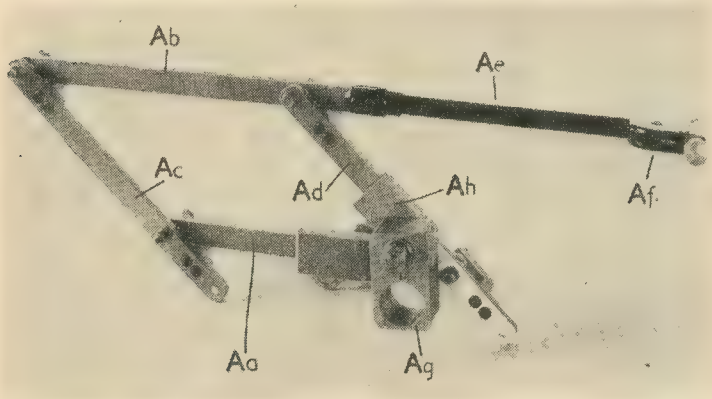


Fig. 7. The pantograph mounting. Ag—the column bracket; Ah—the box-clamp

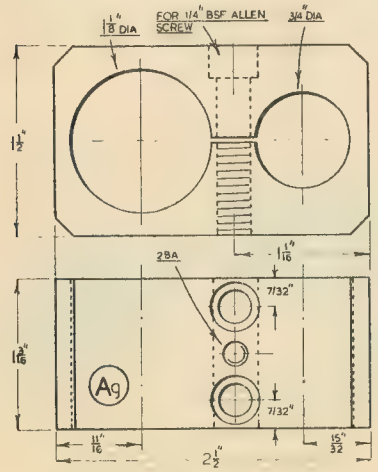


Fig. 8. The column bracket

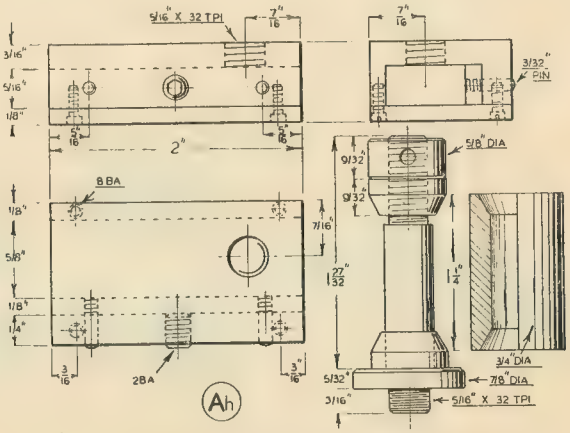


Fig. 9. The box clamp Ah, and the column bracket bush and spindle

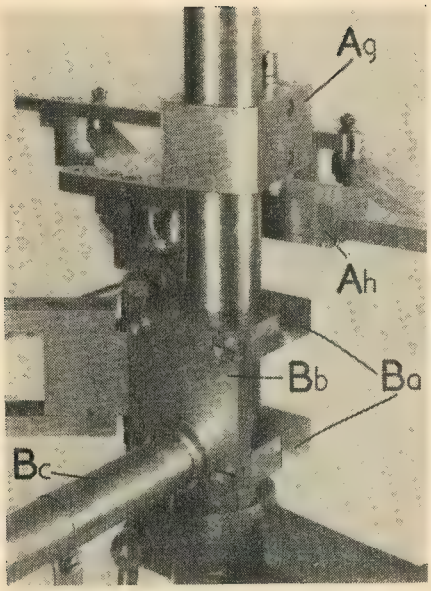


Fig. 10. *The tracing table bracket plates—Ba; the baseplate—Bb, and the tubular arm—Bc*

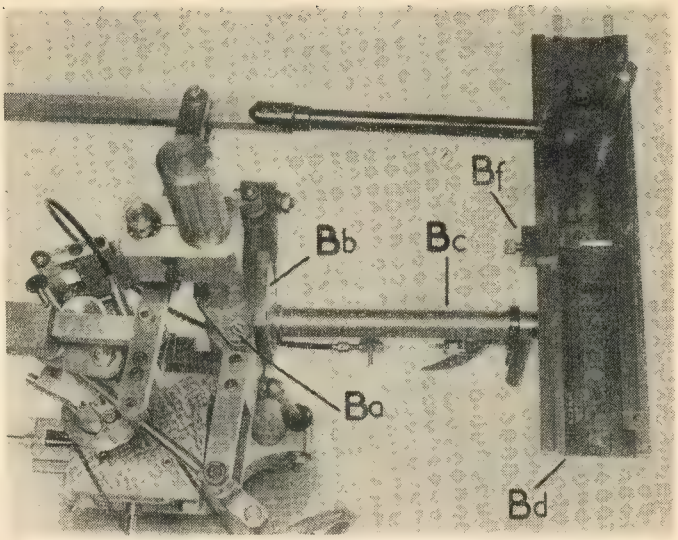


Fig. 11. *Bd—the tracing table; Bf—the cursor*

threaded spigot to screw into the baseplate and, at its outer end, it carries the block with tubular extension on which the tracing table is mounted. To allow for angular adjustment of the table, the tubular part of the block is machined to fit into the tracing table arm, where it is secured in place by means of an expander bolt fitted with a draw-nut.

The tracing table or platten is designed to carry and align a "*Uno*" draughtsman's stencil. A No. 8-size stencil, having $\frac{1}{2}$ in. letters or figures, is actually used in the machine, so that by adopting a reduction ratio of, say, from 2 : 1 to 5 : 1, letters varying in height from $\frac{1}{4}$ in. to 1/10 in. can be engraved on the work-piece. As will be seen in the drawing, a guide strip is fitted to the two long edges of the table and, in addition, a strip of shim steel, bent to an angle section, is secured to the front guide strip by means of spring-loaded screws; the thin, steel strip commonly used for baling packages in transit will serve well for making this part.

By this means, the stencil is maintained in contact with the guide strip and, at the same time, there should be sufficient spring friction to hold the stencil in place during the engraving operation. However, if it is found that the stencil is not securely held in this way without additional finger pressure, a pair of small C-clamps, *Bg*, can be attached to the underside of the table so that, when tightened, they press on the spring strip and lock the stencil in place.

The finished table is secured to the block on the end of the table arm with two 2-B.A. screws and, to make the mounting more rigid, a supporting plate, *Be*, is interposed.

To explain the use of the small cursor, *Bf*, sliding on the guide strip at the rear of the table, it may be as well at this point to describe the method adopted for spacing the engraved letters or figures. After the first letter has been cut, the left edge of the cursor arm is moved into line with the right-hand edge of the stencil letter; the cursor is then clamped in place, and the left-hand edge of the next letter is moved

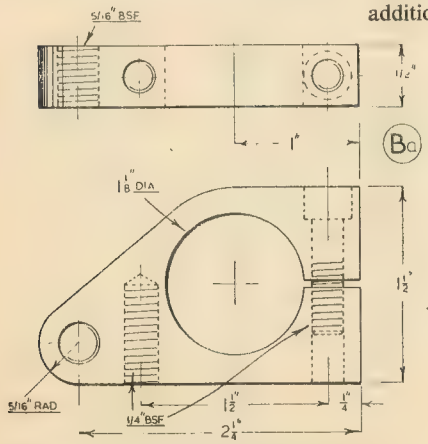


Fig. 12. *The paired bracket plates for attaching the table arm*

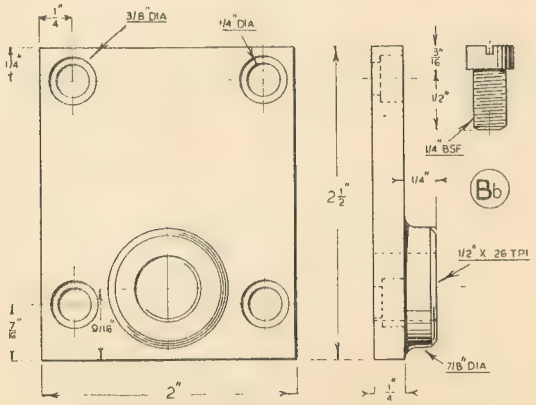


Fig. 13. *The baseplate of the table arm*

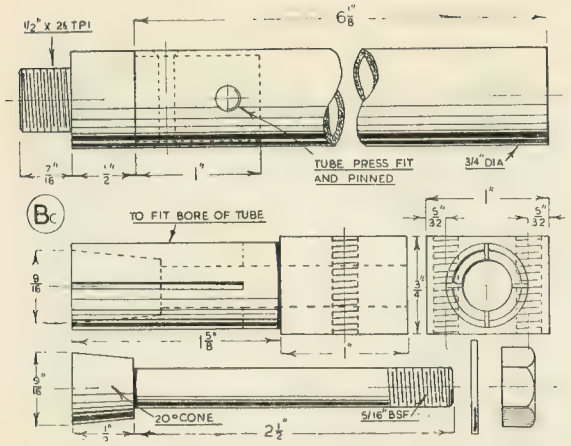


Fig. 14. The table arm and platten mounting

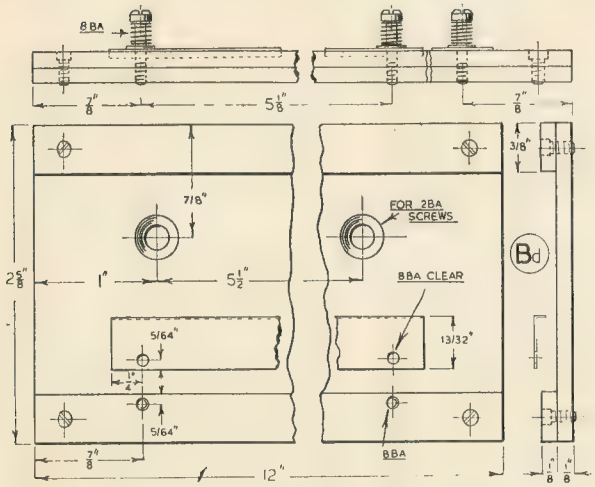


Fig. 15. The tracing table

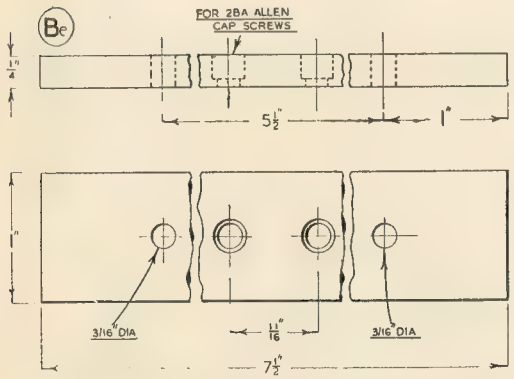


Fig. 17. The supporting plate for the table

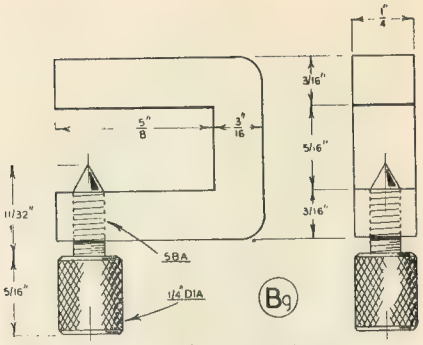


Fig. 16. The stencil clamps

into line with the right-hand edge of the cursor.

By repeating these settings, the engraved letters become evenly spaced, and any variation of the spacing can be made by fitting a wider or a narrower spacing bar to the cursor. When using a "Uno" stencil in this way, we have found that it makes for quicker and more accurate working if the raised rib at the back of the stencil is marked-out with a square and scriber to correspond to the exact width of the letters; this has proved especially helpful for setting two-part letters, such as *B* and *R*.

As shown in the drawing, the cursor clamps to the guide strip fitted at the back of the tracing table. The spring-loaded plunger serves to maintain frictional contact and, when the knurled screw is fully tightened, the cursor is securely locked in position.

There are, no doubt, other and, perhaps, better ways of obtaining equal spacing of the letters, but so far the one described has proved the most reliable and the easiest to operate.

(To be continued)

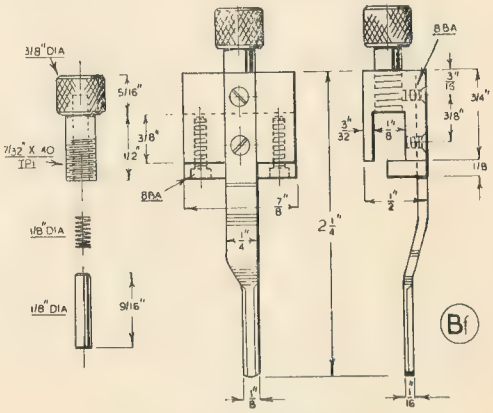
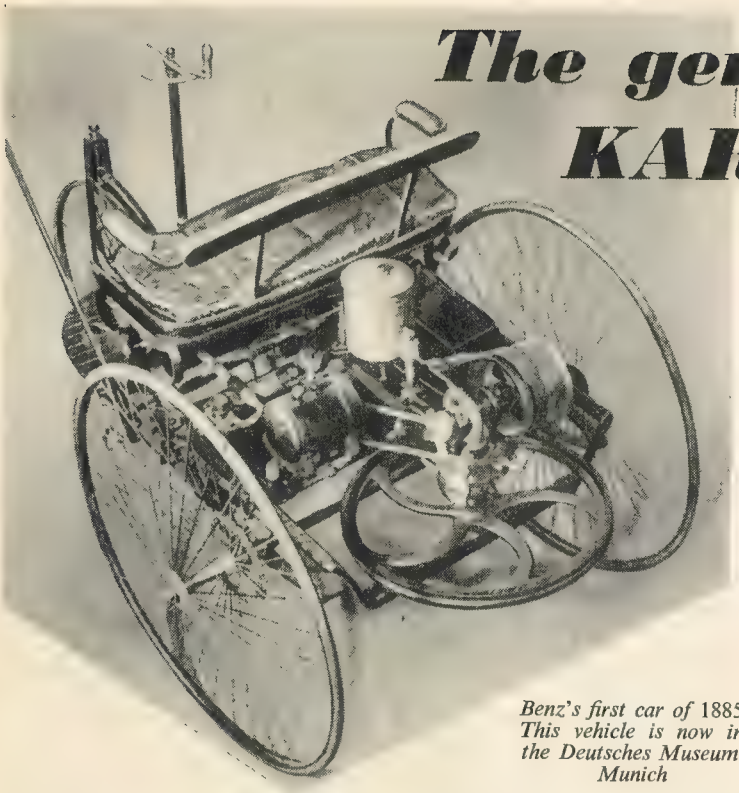


Fig. 18. The cursor

The genius of KARL BENZ

The first successful Petrol-driven Car in the World

By St. John C. Nixon



Benz's first car of 1885
This vehicle is now in the Deutsches Museum, Munich

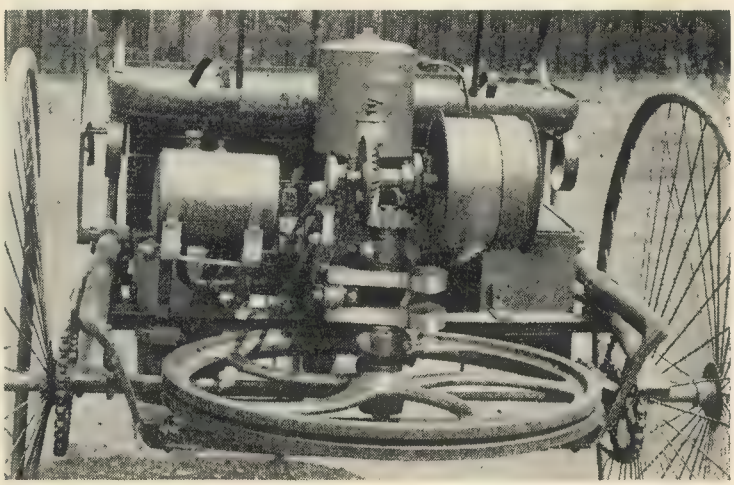
THERE are probably few motorists today who do not know the famous Mercedes-Benz car which has taken part in so many classic events of the past and has been so successful in competitions throughout the world in recent years, but not many are aware of the romantic story attached to the name of Benz, and still fewer that every car running on the roads today is a development of the early work of Karl Benz, the son of an engine-driver and the grandson of a blacksmith in a small village in the Black Forest. For the benefit of those who know nothing of the life-work of this man, let me give a few particulars.

He was born in Karlsruhe on November 25th, 1844; his father died when he was only two years of age, and the sole means of livelihood for his mother and her young son was a miserable pension allowed by the State, which was hardly sufficient to keep body and soul together.

After employment in various engineering firms in Germany, Karl Benz started a small workshop of his own in a back street in Mannheim in 1874 in which he designed and manufactured a few small stationary gas engines. Six years later, another man joined him in business and the two founded the Mannheim Gas Engine Company. Already the thoughts of Benz were turning towards a road vehicle which would be propelled by an engine on the lines of these he was making, but this partner refused to allow a single Pfennig to be earmarked for any such purpose. In 1883, the partnership was dissolved and fresh capital was introduced by two others.

By this, time Benz had a complete design for a horseless vehicle and the product of his genius was first completed in 1884/5. This actual vehicle is still preserved in the Deutsches Museum in Munich. It will be noticed that the engine is at the back of the car and is both horizontal and is turned over on its side, as it were. When designing this crude machine, Benz had nothing whatever to guide him. The world had never seen a petrol-driven motor vehicle, except one or two early experiments which had been quite unsuccessful and had achieved nothing, and of which Benz had never heard.

At 250 revolutions per minute, this engine developed approximately two-thirds of a horse-power, and as



Close-up view of Benz's first car from the rear

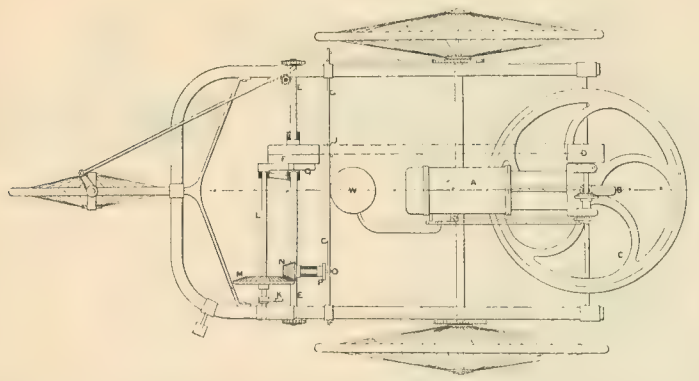


Fig. 1, Plan layout of the car. The single belt conveyed the drive from the engine pulley D to the loose and fixed pulleys F on the countershaft

it was only provided with one forward speed, the ascent of any appreciable incline was out of the question. The enormous size of the heavy flywheel will be noted, and it was this which suggested to Benz that the engine would have to be on its side in order to overcome gyroscopic action, in which event, it would be extremely difficult to steer the machine round corners.

But in spite of its very crude design, it is a remarkable fact that this father of all motor vehicles, had at least four features common to every car running on the roads today. It had a differential gear, electric ignition, water cooling and a mechanically-operated inlet valve (in contra-distinction to an inlet valve of the automatic type which was opened by the suction of the descending piston, this system being almost universal among early designers).

Initial Test

It was in the spring of 1885 that this vehicle was first tested. Round his small workshop, Benz had laid down a cinder track, and the few men he employed, his wife and two sons were all present to watch this historic attempt. There was some difficulty in making the engine fire, but eventually there was a splutter and then an explosion which sounded the death-knell of the horse as a means of transport. A broken side-chain put an end to the proceedings, but Benz was satisfied that his vehicle could now be demonstrated to the public.

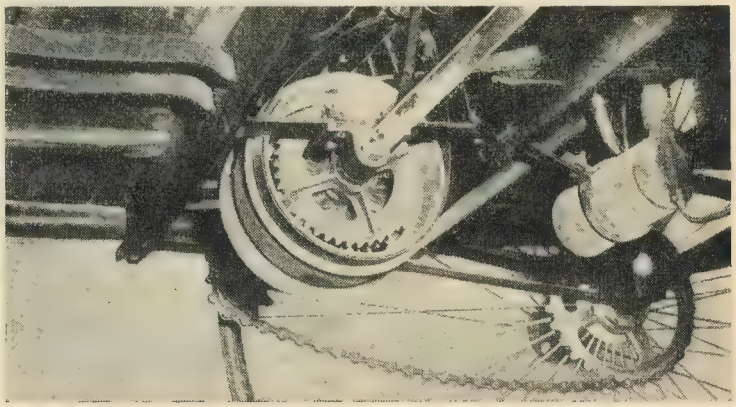
After certain alterations had been effected, he invited a number of prominent people to witness a vehicle propelling itself along the public highways. A vast crowd gathered outside his cinder track, and Benz proceeded to explain in simple language to the invited guests the bare principle of the engine, etc. When the moment for the demonstration arrived, Benz and his wife took their places in the only seats provided, but once again the engine proved obstinate and Benz was forced to work the driving belt from the loose pulley to the fixed. Then some workmen pushed and the engine fired, but whether or not Benz was paying too much attention to his motor and too little to the steering, the fact remains that the brick wall which surrounded the cinder track was noticed too late; there was a heart-rending crash which nearly threw both of them over the front wheel, and there they were with the whole of their vehicle bent and broken almost out of recognition.

Some time was required before the damage could be repaired, but after a series of brief trials on the road, Benz set himself the task of driving it round two circles in Mannheim non-stop. The smaller one was from his workshop, up the Waldhofstrasse to Waldhof and back via Kaeferthal, and the longer route was along the same street, but extended to Sandhofen. If he were to die in the attempt, so he told his wife, his rather less than 1 h.p. car with one speed only, no radiator and with an engine turned over on its side, should carry him and one passenger round these two circles and return to this workshop, unaided and non-stop !

Success at Last

Time after time he made the attempt—usually after dark to attract as little attention as possible—but with maddening regularity something gave way and the vehicle had to be pushed back. Gradually the distance covered, before the inevitable breakdown, lengthened, until on one never-to-be-forgotten evening, in the autumn of 1885 he had the supreme satisfaction of accomplishing his task, and from that moment, the motor industry of the world began.

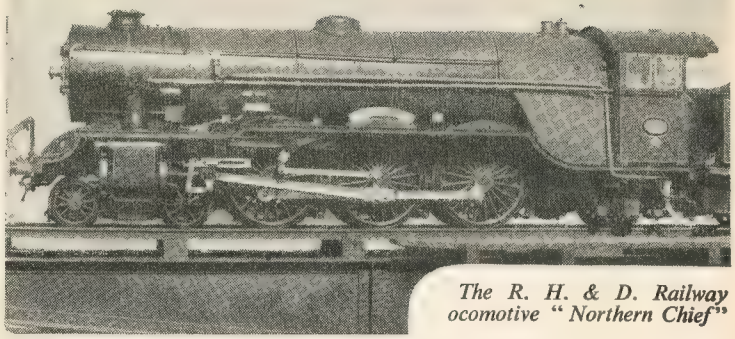
The question has often been asked whether Karl Benz can justly claim to have been the inventor of the petrol-driven motor vehicle. Records exist which show that one or two others before him had carried out certain experiments, but no success attended such efforts. If, therefore, we are to regard the inventor as the first man who made a successful motor vehicle which ran on the public streets under its own power and which gave birth to the motor industry, Benz has an indisputable right to the title.



The differential gear on Benz's car

L.B.S.C.'s Lobby Chat

● SUPERHEATERS



The R. H. & D. Railway ocomotive "Northern Chief"

A CORRESPONDENT who is building the 3½-in. gauge *Titfield Thunderbolt* sent me an amusing letter, the contents of which are worth putting on record. In practically every club and society, there is one wise person who does very little actual work himself, if any at all, but he knows the answer to every problem that turns up, and freely offers unsolicited advice to all and sundry. Well, my correspondent was discussing the boiler of his engine with two or three other locomotive-building members, when Mr. Wiseman butted in. "The design of the boiler is all wrong," said he. "Look at the heating surface that is being wasted, with that one huge flue in the middle. If you fill the available space with small tubes, you'll get more heating surface; and the superheater won't be needed, so you can bring the smokebox tubeplate right to the end of the barrel, and get longer tubes and still more heating surface." The above isn't exactly a "*verbatim* report," but it will serve; and it was followed by an expression of opinion as to why "L.B.S.C." wanted to introduce a superheater at all, when the original engine never had one, and a comment on that person's abilities as a boiler designer, and why a "scale model" of the original boiler would be a far better proposition.

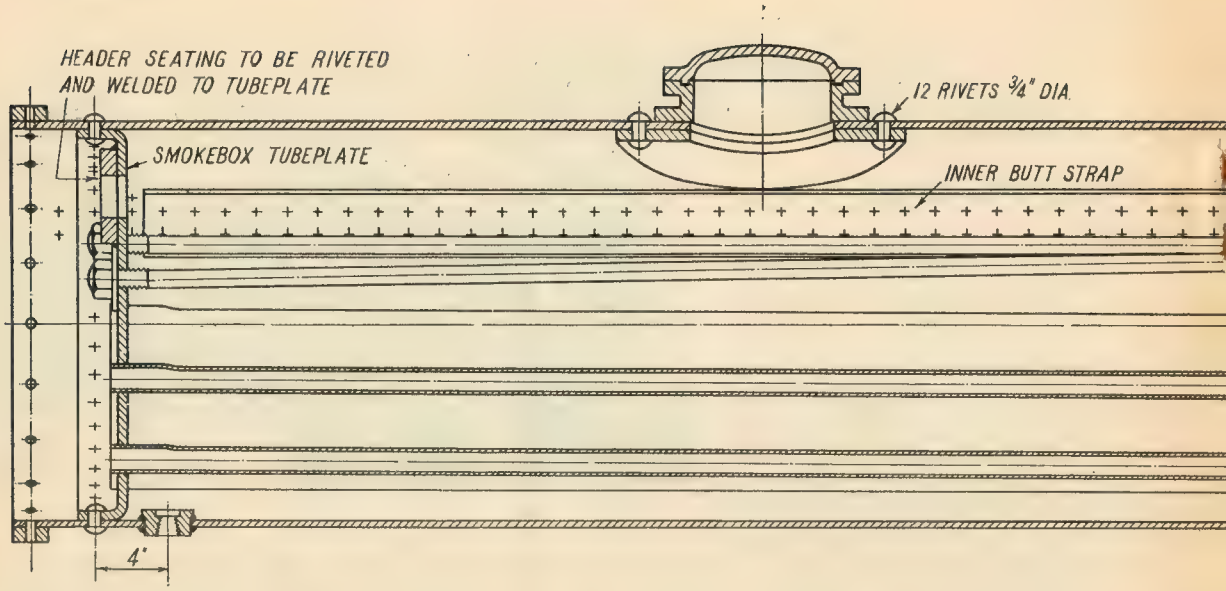
Proof Needed

To the intense surprise of Mr. Wiseman, instead of his "sockdolager" being received with the due solemnity which befitted such a display of knowledgeable eloquence (says Webster's Dictionary !) it was greeted with smiles by the company assembled, and my correspondent retorted: "As you know all about it, maybe you'll tell us how many boilers you've actually built, and whether any of them steamed better that a boiler built to L.B.S.C. design. We've never seen any of them here !" At this, Mr. Wiseman visibly began to wilt, and started to argue about "square inches of heating surface," and the other stock-in-trade items which we all know so well. Anyway, to cut a long story short, Mr. Wiseman was politely told the exact spot at which he should alight from the bus, and advised to prove any arguments he submitted about boiler design, on the track, under service conditions, as "L.B.S.C." had already done.

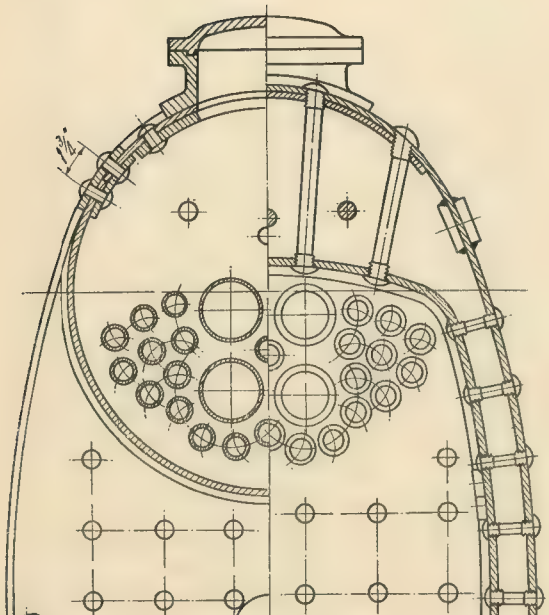
Naturally, your humble servant was rather tickled to read the letter, and I passed a mental vote of thanks to my unknown but trusty henchmen, who placed such faith in my instructions. I thought that the fallacy of "square inches of heating surface" being the be-all and end-all of a boiler's efficiency, was (unlike the boiler !) exploded long ago. To prevent any newcomers to our craft being misled by such argument, may I once more state, that it isn't the "square inches of heating surface" that make a boiler steam, but the *amount of heat that is applied to them.* Also, there is all the difference in the world, between wet steam and hot steam. Supposing wet steam—that is, steam straight off the water in the boiler—is admitted to a cold cylinder; what happens ? The cold metal absorbs the heat, and the steam condenses into water, the process continuing until the metal warms up sufficiently to check condensation, and allow part of the incoming steam to do the job it is supposed to do, viz. push the piston. How much steam at boiler temperature is needed to do this, and maintain the temperature of the cylinder walls, steam chest, etc., naturally depends on the size of the cylinders; but in any case, all unprejudiced persons will at once realise that it is a dickens of a lot, and—very important this—it all has to come from the boiler, ***via the water.***

Now supposing that the steam, instead of coming direct from the water in the boiler, is passed through one of the multiple-element superheaters that I specify in my boiler designs, and is heated up to over twice its initial temperature, before it enters the cylinders. I should imagine that the veriest Billy Muggins could grasp the simple fact that *all that extra heat has to be absorbed by the cylinder walls before any condensation takes place at all.* Therefore, it requires far less of the hot steam to heat up the cylinder and start the piston-pushing antic; and as the hot steam maintains the cylinder temperature well above condensation point when running, the whole of the steam entering the cylinder is available for piston-pushing. The above may not be the kind of explanation that the "scientific" fraternity would give; but it is the simplest that I can think of, and should enable any raw recruit to grasp why far less superheated steam is needed to run a locomotive at a given speed with a given load, than wet or "saturated" steam.

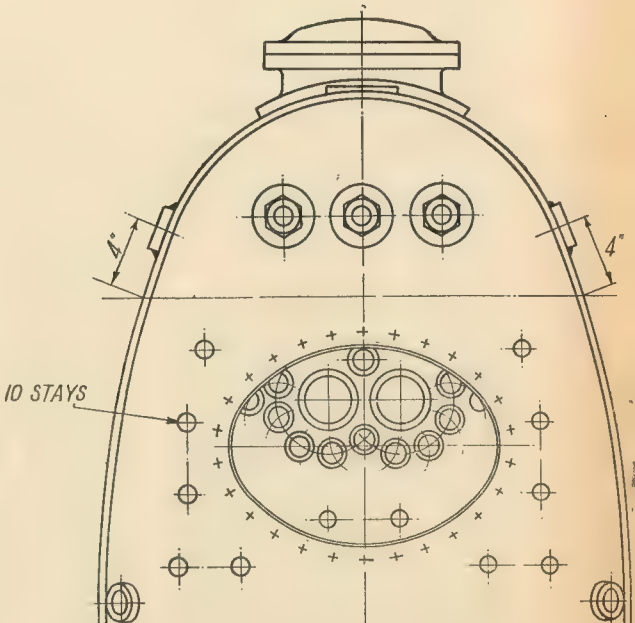
There are two further advantages; the extra heat put into the steam requires no further effort from the boiler. The superheater elements simply mop up heat that would otherwise be wasted through the tubes and chimney; and the hotter the steam, the greater its elasticity, or "fluidity" as it is sometimes called, enabling it to enter and leave the cylinders much quicker, and allowing of a greater degree of expansion. The former advantage makes the engine "step lively," and the latter economises on the coal and water.



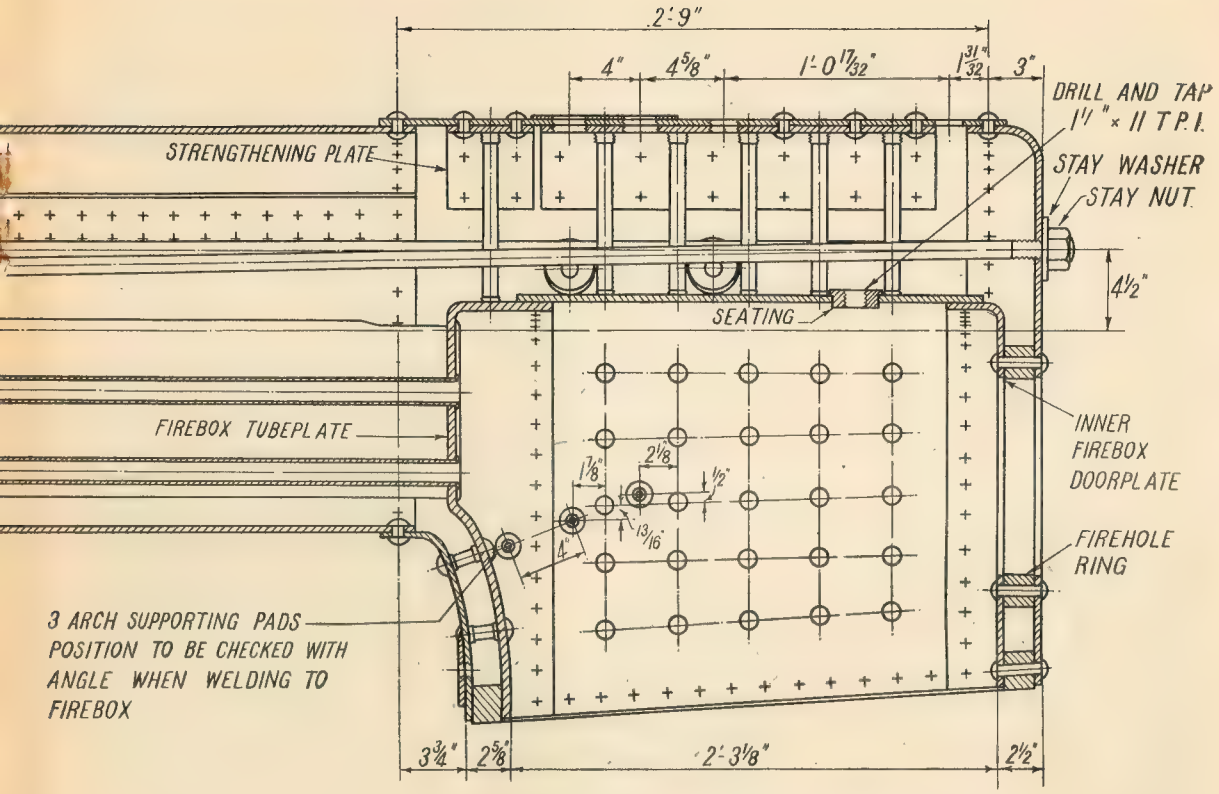
Sectional elevation of superheater boiler for Romney Hythe and Dymchurch Railway engine "Northern Chief"



Cross sections through barrel (left) and firebox (right)



Back end view, showing large size of firehole



Mr. Wiseman's Error

The advice given by the "lad who knows all the answers" simply betrayed his ignorance of the above simple facts. Supposing our friend who is building the *Tit* had listened to the advice and acted on it; he would have found that, despite the extra square inches of heating surface gained by adding more small tubes in place of the superheater flue (I haven't worked out the figures, but at a rough estimate, the addition would be small) the amount of steam at water temperature, needed to maintain the cylinders at working heat, and drive the engine as well, would have been more than the boiler could generate; and the engine would have been a failure. She would only require half the amount of superheated steam; and, therefore, the boiler, even with much less heating surface than specified, would supply all the steam needed. I might tell you right here, that the design of the 3½-in. gauge *Tit* boiler wasn't the result of guesswork; it was based on the boiler of my old *Ancient Lights*. This "old iron" will start off with 35 lb. showing on the "clock," just enough pressure to start with my weight on the car; and before she has completed one lap of the line, she will be blowing off skyhigh at both safety-valves even with the pump working, and the firehole door has to be opened a little, to keep her quiet. With twice the superheating capacity, the *Tit* boiler should be more efficient still.

There are hundreds of locomotives still plying the tracks of British Railways on wet steam, and in most cases, doing the job in a satisfactory manner; but they are all older types, and although they would be vastly more efficient if superheated, it wouldn't be a paying proposition to convert them, as they would be worn out before the saving made by the superheaters had balanced the cost of conversion. That is just a plain study in "economics" (another word I detest !), and the only reason that I mention it, is because certain folk aver that their engines do just as well on wet steam, as they would if superheated. Not on your life ! I've made experiments with not one, but several engines, with both wet and hot steam; and the results, both in performance and economical running, show the amazing difference that really hot steam makes. I'll mention just one. A firm whom I nicknamed the "junk merchants" (they *were* !) built some locomotives for a 2½-in. gauge "scenic" line owned by the late Sir Aubrey Brocklebank, then a director of the G.W.R. By virtue of his knowledge of locomotive construction and operation, he should have been C.M.E. as well. He used to visit me at my old home at Norbury, and it was he who brought Mr. Collett along; some happy hours were spent on my old line at that address.

I rebuilt some of the "duds" for Sir Aubrey, and he gave me three of the engines for keepsakes. One of these was a Great Central single-wheeler. I bored out the cylinders to 11/16 in. and altered the valve gear to my own pet arrangement. As the cylinders were brass, and the makers of the engine were afraid that their "all-or-nothing" so-called displacement lubricator might fail, and allow the cylinders to get scored in the

bores and portfaces, should the steam be too hot, they just took the steampipe back an inch or so into the space between the outer casing of the boiler, and the inside barrel. The boiler was of the water-tube type. I "canned" the original spirit-burner outfit, and fitted one of my Carson-type oil burners, leaving the apology for a superheater loop as originally fitted.

On trying the engine, she went all right, and made plenty of steam; my oil-burner saw to that! However, she ran much wetter than my other engines, and used a lot of water; so I thought I would see how much real superheat she would stand. The short looped steampipe was taken out, and replaced by a long loop with two complete coils right in the flame of the oil-burner. To make sure she got enough oil, I altered the lubricator as well. The next time she was in steam, the difference was astounding. The coils in the flame of the oil-burner became bright red and remained so, while the engine was running, so that the steam just became a breath of scorching gas, with not the faintest sign of white exhaust from the chimney on a very cold winter's day. She was not only as lively as a kitten, but the water lasted over twice as long as it previously did, running on my 65 ft. straight road.

I still had her when I came to this hacienda, and she performed as well as ever, on my original straight line in the cutting. When the new continuous line came into being, at long last, I fitted a new mechanical lubricator, to ensure a constant supply of oil (the brass cylinders needed plenty, as you may guess) and found that she would run for nearly 40 minutes non-stop on one filling, hauling my weight. She did a fair amount of running, and one day the late Ed Meers saw her and took a fancy to her At that time he was running the East Kent Engineering Co. in Burgate Street, Canterbury. I let him have her in exchange for something (I forget now what it was) and he kept her at the shop; it was through that she came to an untimely end. On the night Jerry air-raided Canterbury, he missed the cathedral, and flattened Burgate Street instead; and the little engine was completely destroyed, along with several others.

Hot Steam

The dreary reiteration that "they go just as well on wet steam," is not only stupid prejudice, but contrary to facts. If they did, why would new full-sized engines be fitted with superheaters, which not only add to the cost of the engine, but need maintaining? And you can take it from Curly, who has had the experience, that the hotter you can get the steam, within reason, the more efficient and lively will be the engine. The smallest boiler fitted to any old-time tank or tender engine, can be fitted with a superheater; and to make room for the headers, all you have to do is to recess the tubeplate at the smokebox end, into the barrel. My good friend Roy Donaldson, the Ashford draughtsman who is the original of "Sir Roy" of the tales, is building a 3½-in. gauge G.W.R. "Armstrong" 0-6-0 goods engine, the components of which are gleaned from various engines which have been described in these notes. The valves are between the cylinders. She will have a "scale" boiler, as far as externals are concerned, and the huge brass dome; but the tubeplate will be recessed and a multiple-element superheater fitted.

The Romney Hythe and Dymchurch Superheater Job

A striking example of the benefits of hot steam, compared with the wash-day variety, is presented by the results obtained with the Romney Hythe and Dymchurch locomotive *Northern Chief*. The original boilers were furnished with a kind of smokebox grid. This was soon found to be useless for superheating purposes, and the grids were removed, the steam pipes being directly connected to the cylinders. The locomotives were always very heavy on coal and water, for the work they performed, and it was eventually decided to rebuild one with a superheater boiler. By the kindness of friend George Barlow, who obtained the drawings for me, and of Capt. J. E. Howey, who gave permission to publish them, I am now enabled to give a few details of the new boiler.

It was designed by Mr. Ian P. Hunter, and arranged so that it could be fitted to the locomotive with the minimum amount of alteration. The firebox tubeplate is slightly recessed into the barrel, and there are four large superheater flues, to accommodate a multiple-element superheater of the usual pattern. Note the very large firehole. A plate is fitted over the header on the smokebox to give easy access to same; and the piston-valves and cylinders are supplied with oil by mechanical lubrication, as can be seen from the photograph on page 407.

Now friend George has a pretty extensive circle of friends who own and operate miniature railways from 9½-in. gauge downwards, and he goes around visiting, whenever opportunity offers, running his friends' locomotives. He, therefore, has a very extensive practical experience of the behaviour of small locomotives in actual service, apart from his job as foreman-driver on the R.H. & D. Incidentally, I wonder that our old nighthorse Inspector Meticulous has not pointed out, ere this, that the correct title should be Romney, Dymchurch and Hythe, seeing that Dymchurch is the middle station. George has visited my line at intervals, and when I ask him what he can find of interest in my little fleet of 2½-in. and 3½-in. tea-kettles and coffee-pots, after some of the larger fry that he is accustomed to run, he just smiles and replies "Their efficiency." He has remarked more than once that a real "dream of Heaven" would be to have a 15-in. gauge replica of my *Jeanie Deans* (his favourite engine) on the R.H. & D. "Bluecoaster"; he could make up the fire before starting, then open the regulator, notch up, and sit back and enjoy the scenery and the sea breezes for the rest of the journey!

Friend Barlow's regular engine on the R.H. & D. is *Green Goddess*, and considering her ravenous appetite for coal and water, *Greedy Goddess* would be a more suitable moniker. He says she seems more hungry and thirsty than ever, after he has had a spell on my road doing lap after lap without picking up the shovel. The difference in coal and water consumption by *Northern Chief* is just nobody's business, since the new superheater boiler was fitted; she only needs about half the amount formerly used for the same work, and there is a marked improvement in her speed and liveliness.

The reproduced drawings of the boiler are self-explanatory; the photograph in the heading of this "Lobby Chat" was taken by Mr. C. J. Grose on the last occasion that he visited the railway. The only comments that I have to make, are that if I were designing a similar boiler, I should more than double the superheating surface, and specify a really big combustion-chamber. The latter would have added considerably to the most effective heating surface in any boiler, as my experience is that one square foot in the firebox, is worth three in the tubes. In the firebox, you get the effects of both radiation and convection; in the tubes, convection only, and that seems to be just the one thing that the "square inches" fraternity have apparently overlooked!

ARTS and CRAFTS "On Parade"

An almost completed 3½-in. gauge "Britannia" which gained a second prize

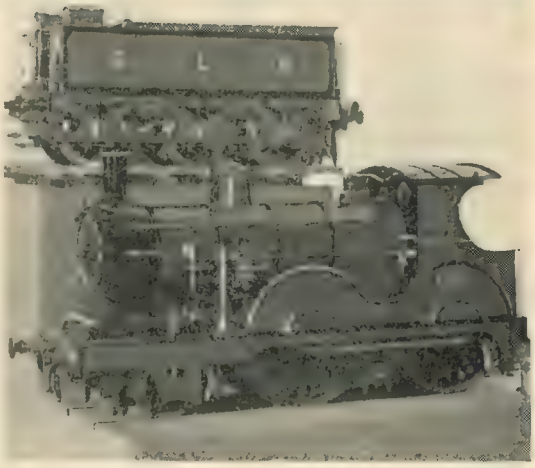
ONE frequently hears it suggested that far fewer people have time, inclination or application, these days, to settle down to serious handicrafts, hobbies and forms of artistic expression. Readers will appreciate that the "Model Engineer" Exhibition goes far to demonstrate the falsity of this belief, but further vindications are always gratifying, and the recent Arts and Crafts Exhibition of the Electricity Supply Industry, in London, provided this in the widest sense.

There were 29 classes for exhibits, comprising very many fields of activity, but from the point of view of model engineering, interest really centred on those categories embracing models, metalwork, apprentices' work, and musical instruments—all the last mentioned, incidentally, being violins.

The model engineering was varied and interesting. The predominance of ship models was somewhat striking, but of course, the construction of decorative and not always highly practical galleon models has become almost a cult, and a number of these, of varying virtuosity, swelled the ranks.

An Elizabethan galleon which was the work of R. D. Bye seemed to be of a particularly high standard, and among other boats the now well-known and remarkable model of the *Arnhem* richly deserved its premier award. Some idea of the work put into this ⅛-in. scale model may be derived from the knowledge that its hull is made from 250 tinplates, whilst the four decks contain 186 chairs, 62 tables, 132 washbasins, 140 bunks and—as the *piece de resistance*—14 glasses and a decanter. There was a very good plywood cabin cruiser by a 16-year-old boy, Rowland H. Bartlett, and it was nice to see a dainty glass-case model of the *Herzogin Cecilie*.

This lathe deserved its "first"



This 3½-in. gauge G.E. locomotive was a popular attraction

Many excellent examples of locomotives, traction engines and power units were to be seen, including C. H. Crosby's *Juliet*, which was described in THE MODEL ENGINEER dated August 20th, 1953, and an attractive maroon-and-yellow showman's traction engine which won an award. Aircraft models included an early monoplane, a large glider, a "solid" Lancaster bomber, and a likeable little Avro 504K biplane.

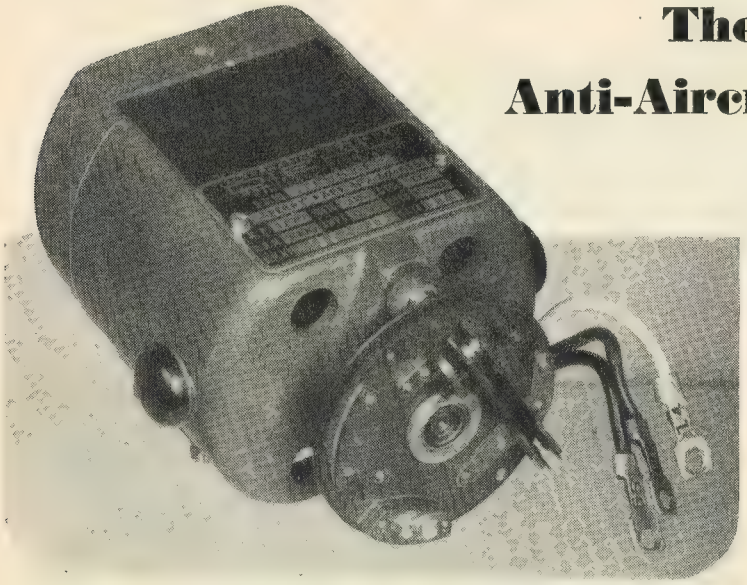
The apprentice work was of a very high standard, effectively symbolised, perhaps, by M. J. Maynard's faultless pair of Stillson wrenches—so finely finished as to appear to be chromium-plated. First-prize winner R. V. Phillips exhibited a finely-wrought set of tools, including scriber, scribing block and tap wrench.

In the metalwork section, the lathe made by F. F. Few was the big attraction, closely rivalled by a set of lathe tools by A. C. Jensen.

ADAPTING EX-SERVICE APPARATUS — NUMBER ONE

The Sperry Anti-Aircraft Predictor

By "ARTIFICER"



The driving motor, with centrifugal control switch on end of shaft

IN the series of articles entitled "Swords into Ploughshares" published during 1947-48, an attempt was made to describe in general terms, some of the ex-service apparatus then available on the "surplus" market, and the uses to which it might be applied or adapted for model engineering purposes. The usefulness of these articles has been attested to by a large number of testimonials from readers, but there has also been an even greater number of queries asking for more detailed information on specific items, some of which have become available since the articles were published. These queries have in most cases been answered to the best of the writer's abilities, but unfortunately it has not been practicable to obtain and analyse samples of every piece of "surplus" apparatus offered for sale by THE MODEL ENGINEER advertisers, and thus there have inevitably been many failures to supply the desired information, and apologies have had to be made in these cases.

An attempt is now made to rectify some of these deficiencies and amplify information already available, by taking individual pieces of ex-service apparatus, breaking them down into their component parts or sub-assemblies, and suggesting how these can be utilised or adapted. This is a somewhat different angle of approach from that of the former articles, and the chances of its success depend on two important factors; first, whether it meets the requirements of readers, and second, whether the co-operation of advertisers can be had in obtaining samples of apparatus which can be dissected, tested and reported on.

It is proposed to start with an instrument which has been released for sale on the "surplus" market within the last few months; one of great ingenuity and complexity, which contains several sub-assemblies and components adaptable to model engineering applications.

The Component Parts

This instrument is one of a very wide range of integrating or calculating machines which have been evolved for purposes such as directing fire, range-finding, submarine detection etc. In some cases they have now been superseded by radar equipment, but sometimes they are used in conjunction with it; in any case, it is not necessary to describe how they work in detail, as it is rather unlikely that the complete instrument will be used by amateurs. Suffice it to say that in all cases certain data, which may be obtained by visual or radar observation, is fed into the instrument, which automatically makes calculations directly applicable to the bearings of guns or other missile projectors, or utilised in nagivation.

In this particular case, the following sub-assemblies are contained, capable of being removed as self-contained units: 1 electric motor, 2 variable-speed friction drive units (different sizes), 4 differential gears, and 1 worm reduction gear unit. Besides these, there are numerous spur gears, ball-races, shafts, brackets, springs, screws, nuts, etc.

Motor

Unlike the majority of instruments in this class, which usually have low-tension d.c. motors, for voltages not exceeding 24 to 30, the driving motor in this case is designed to run on 115 volts, 60 cycles a.c., but it will run on 50 cycles with slightly less power, and being of the series-wound commutator type, it will also run on d.c. of somewhat lower voltage. It may thus be described as a "universal" motor, and it may be adapted to run on 200 to 250 volt a.c. mains by means of a transformer having an appropriate output voltage. For running on 200-250 volts d.c., a ballast or "volt-dropping" resistance is necessary, preferably the type with a clamp or other movable contact for adjusting it to requirements; about 250 to 300 ohms will be required, with a current capacity, without undue heating, of not less than 1amp. This resistance can also be used in place of a transformer on a.c., but it is a wasteful method of reducing voltage, as the energy represented by the excess voltage is dissipated in heat.

The motor is equipped with a speed-governing device, consisting of a contact-breaker operated centrifugally, to cut out the motor current supply when a pre-determined speed is reached; normally 3,000 r.p.m., but adjustment is provided in the latter respect. This device is a self-contained unit, mounted on one

end of the motor shaft, with slip-rings which collect current from spring-loaded brushes on the end of the motor body. For many purposes, constant speed control is very useful or even essential, but if it is not required, the entire control unit can be removed, and the two slip-ring brushes short-circuited. If manual control of speed is required, a control rheostat could be introduced, either between these brushes or in series with the main supply circuit; for a full range of control, about 500 ohms will be necessary. This could be incorporated in the volt-dropping resistance, but if so, a stop should be fitted to prevent the possibility of applying excess voltage to the motor.

The continuous power rating of the motor is 1/70 h.p. with maximum current consumption of 0.95 amps, so that it is capable of much higher power output for short periods. It is thus suitable for many small power applications, including driving cine-projectors, display devices, models, light grinding or drilling spindles, etc. The approximate dimensions of the motor are $5\frac{1}{2}$ in. long over shaft, $3\frac{1}{2}$ in. wide by $2\frac{1}{8}$ in. high. A radio suppressor unit for the motor is also available.

Variable Speed Units

The two units differ not only in size, but also in details of design, though the working principle is exactly the same in each case. They enable power to be transmitted at right-angles, being fed in at a constant speed, and having an output at any speed from zero to maximum in either direction of rotation. The input shaft drives a steel disc, adjacent to which is a cylinder with its axis at right-angles to that of the disc, and interposed between the two is a steel ball which is free to roll, but controlled sideways so that it can be moved across the face of the disc by a slide, operated by a rack and pinion. Thus the ball acts as a sort of idler or intermediate gear which transmits motion from the disc to the cylinder by frictional contact, at a speed ratio which depends on the surface speed of the disc at the point where the ball touches it.

When the slide is adjusted so that the ball is located exactly at the centre of the disc, no motion is transmitted, because the surface speed at this point is zero; in other words, it may be said that the ratio of speed reduction is infinity. By moving the ball outwards toward the edge of the disc, however, the surface speed at the point of contact gradually increases, so that motion is transmitted at a speed increasing to maximum when it reaches the edge of the disc. This applies whether the ball is moved to the right or left of the centre, but the direction of transmitted motion is reversed when it crosses the centre point, so that a full range of speed variation in either direction can be obtained.

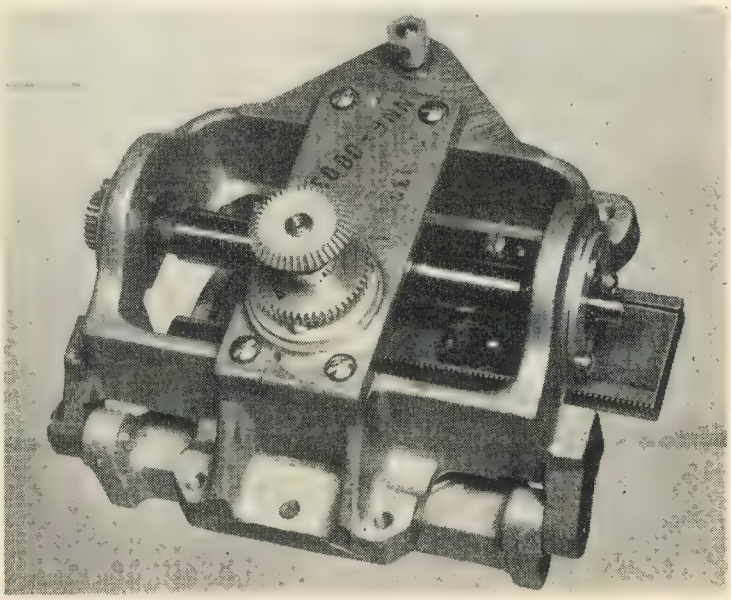
The friction gear may thus be regarded as the equivalent of a multi-speed reversing gearbox, with the additional refinement of "stepless variation," and it is, therefore, applicable to many purposes in power transmission, and particularly for traction of road vehicles. As the controlling force required is light, it is applicable to radio or other remote control, and the progressive action enables very delicate operation of the control to be obtained. The amount of torque which can be transmitted is, however, limited, as slip will take place when it is overloaded; some control of torque is possible by adjusting the loading spring. At the normal working speed, it is estimated that the larger of the two units, measuring approximately $5\frac{1}{2}$ in. $\times$ 5 in. $\times$ $4\frac{1}{4}$ in., would transmit 1/30 h.p., and the smaller, measuring $3\frac{1}{2}$ in. $\times$ $3\frac{3}{8}$ in. $\times$ $2\frac{3}{4}$ in., would transmit 1/50 h.p. comfortably; but at higher speeds, the same torque capacity would cope with proportionately higher h.p. and as the shafts run on ball-races, they would safely withstand the higher duties.

Differential Gears

These are of the spur-geared type, having two pairs of intergeared "planet" pinions on diametrically opposite sides of a cage or "spider" mounted solidly on the shaft; these mesh with "sun" wheels on sleeves which run freely on the ends of the shaft, and have other gears, varying in size from 50 to 80 teeth, attached to the outer ends of the sleeves. All gears are 48 d.p.

Apart from the obvious application of differential gears to facilitate cornering of road vehicles, they can also be used for other purposes, such as to provide a means of phase adjustment between driving and driven shafts; that is to say, relative "timing" variation while running, without disconnection of positive engagement. In this way, one of the units could be employed as a torsion meter or torque dynamometer to measure the power transmitted from one shaft to another.

The gearing can also be used to provide a reduction or a reversal of speed between driving and driven shafts. If one of the "sun" gear sleeves is driven and the other held stationary, the spider will be driven round at half the driving shaft speed; but if the spider is held stationary, the second sleeve will rotate at the same speed as the driving shaft, but in the reverse direction. By a suitable arrangement of clutches and brakes, the unit could thus be made to provide two speeds and a reverse



The larger of the two variable-speed friction drive units

(Top) The smaller friction drive unit
(Centre) Worm shaft and pedestal, with separate worm gear
(Bottom) Two of the spur-geared differential units

and this principle has often been applied in motor car transmission gear, being one of the forms of "epicyclic" gearing—one of the simplest yet most versatile arrangements of gear drive known. The various sizes of external gears attached to the sleeves enable further variations of gear ratio to be obtained. These units are 2 in. long over shaft ends, and $1\frac{3}{16}$ in. diameter over the spider; four of them are contained in the complete predictor mechanism.

Worm Gear Units

The pedestal casting of this unit carries a shaft in two ball-races, with an integral 5-start worm in the centre and a dog coupling on one end. A loose bronze worm wheel of 51 teeth is provided to mesh with the worm, giving a reduction ratio of 10.2 to 1. This gearing could thus be very easily applied to a small electric motor, or other source of power. Worm gears enable a large ratio of speed reduction to be obtained in a single stage, and generally work more quietly, and often more efficiently, than spur gears when such a high ratio is required. Typical applications for worm gears include hoists, cranes, conveyors, elevators and display devices of all kinds. The size of this unit is $2\frac{1}{4}$ in. × $2\frac{1}{8}$ in. × $2\frac{1}{8}$ in. approximately overall.

Ball-races

In addition to the ball-races incorporated in the sub-assembly units described, a number of others are employed for carrying drive shafts in the complete mechanism. These are all of the single-row deep groove type, with pressed steel cages, by the New Departure Co., U.S.A., and are in two sizes, both $\frac{1}{4}$ in. diameter in the bore, but $\frac{3}{4}$ in. and $\frac{5}{8}$ in. external diameter respectively.

Spur Gears

A number of spur gears in steel, bronze, and hard light alloy, from 40 to 140 teeth, all 48 d.p., are also contained in the assembly. These, of course, have many applications in model work and all kinds of light machinery, but in addition can also be used in technical education. By making a slotted frame with adjustable studs, gears may be set up in various combinations and arrangements, enabling various principles of mechanics to be effectively demonstrated.

The items described here were obtained from Messrs. H. Franks, New Oxford Street, London, W.C.1, who can supply them either in complete sets, or separately.

Mechanical Handling

INDUSTRIAL TRUCKS AS PROTOTYPES FOR MODELS

PAINSTAKING research into prototype subjects for model-making can be not only a fascinating hobby in itself, but can lead to the construction of accurate scale models, of unusual and probably highly-specialised type.

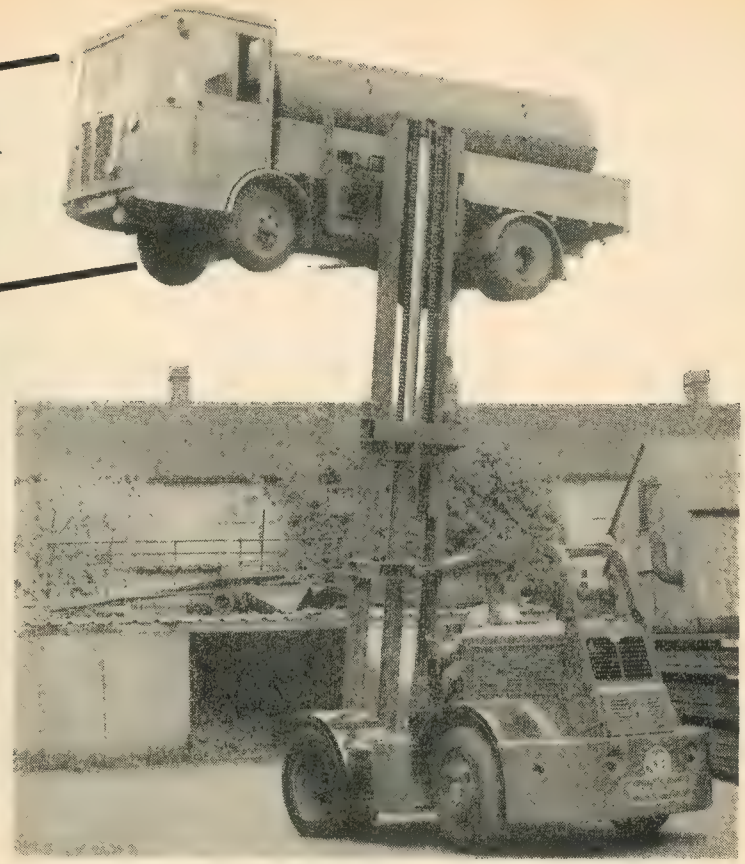
A field in which this might well apply is that of industrial mechanical handling. Mechanical handling, in this instance, does not mean the use of roller and belt-type conveyors, overhead chain systems, cranes and grabs, etc., but the more interesting field of wheeled vehicles designed to ease all kinds of handling problems.

A prominent firm of toymakers has already ventured into this field with a scale model of a well-known fork truck and there is tremendous scope in that type of vehicle alone. Most manufacturers, it is suggested, would be prepared to co-operate in providing information, photographs and possibly drawings.

The writer has had occasion to study this form of mechanical handling over a period of years and it is felt that the following description of a simple low-capacity type of unit may be of particular interest as it would seem to lend itself so well to copying in miniature. It is a truck known as the Matbro.

The machine which the writer has in mind is of one-ton carrying capacity. It follows the lines of most fork trucks in general principles, but it is notable for what is called "return drive" from engine to driving axle. That is to say, the drive travels through 180 deg., the output end of the engine pointing away from the front (driven) axle and returning after passing through the gearbox.

Other features which may not necessarily be considered typical are the use of comparatively large pneumatic tyres (which, on account of the return drive, can be accommodated within a very short wheelbase) and an overhead cylinder for tilting the forks, instead of some arrangement at the base of the forks. This double-acting hydraulic cylinder supported by a robust stanchion, has a long stroke, allowing a mast-tilt of 12 deg. back and 4 deg. forward.



This gives some idea of the capabilities of the larger type of fork truck

The mast assembly is of course also hydraulically operated, in this case by means of a single-acting lift-cylinder, and is all roller-mounted, eliminating sliding contacts. A spill-pipe carries excess oil back to the reservoir.

Hydraulic equipment consists of a gear-type pump, vee-belt driven from the engine. Oil supply is controlled by a valve feeding the hydraulic rams via armoured flexible pipes.

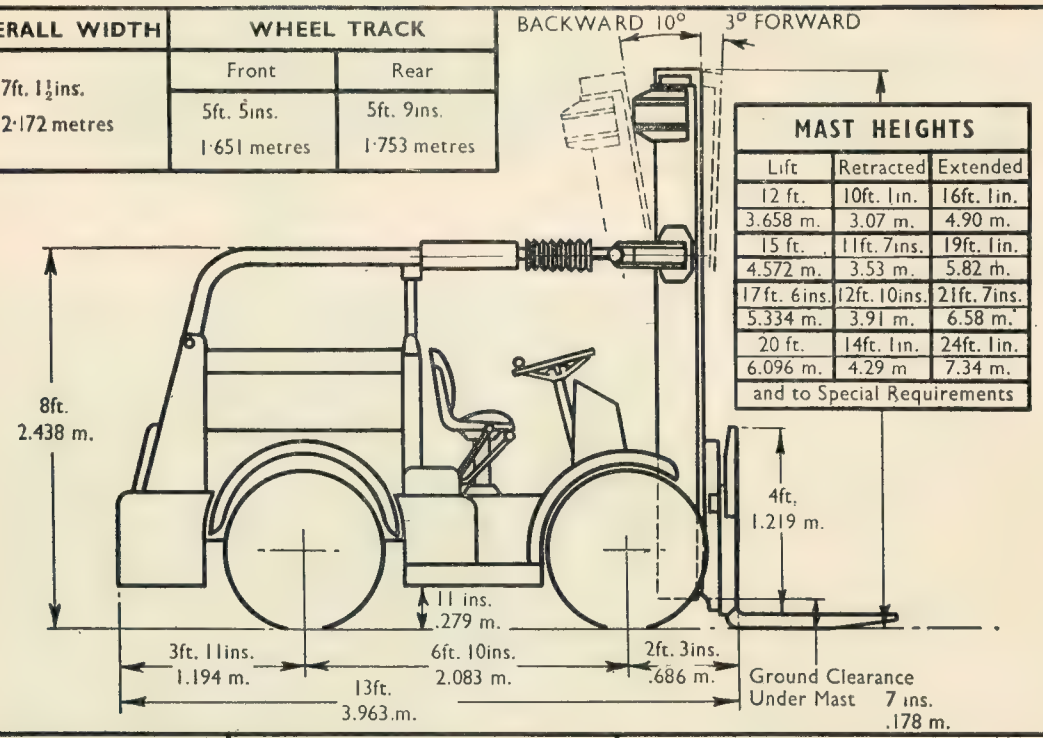
Engine and transmission, which consist of a Ford 10 h.p. engine and a three-speed and reverse gearbox, are so mounted as to be removable without disturbing the hydraulics. Part of the charm of most of these vehicles lies in their high degree of manoeuvrability and in this case the vehicle has a turning radius of 75 in. Lifting height is 12 ft., at a speed of 36 ft. per minute.

Not the least interesting thing about the fork truck as a type, from the model maker's point of view, is that it could operate in a miniature contractor's yard, and could be made to lift and stack, etc. Moreover, there are various fascinating attachments which can be fixed on to or in place of the forks and which will adapt the truck to a variety of purposes.

Probably the most common attachment is the fixed jib, which, as its name implies, can be used as a small crane, with a hook which slides, so as to vary the range. Another popular one is the tubular-section boom, which can be used for handling coiled material, rolls of paper, etc. Then, on the heavier types of truck there may be a dozer blade of traditional style, made from heavy steel plate with hardened leading edge. This can be used as a bulldozer (with blade straight or as an angle-dozer (with blade fixed diagonally).

Sometimes a heavy steel shovel is fixed to the front of the truck and is so arranged that it is possible to dump the load from any desired height, by means of a trip-line within easy reach of the operator.

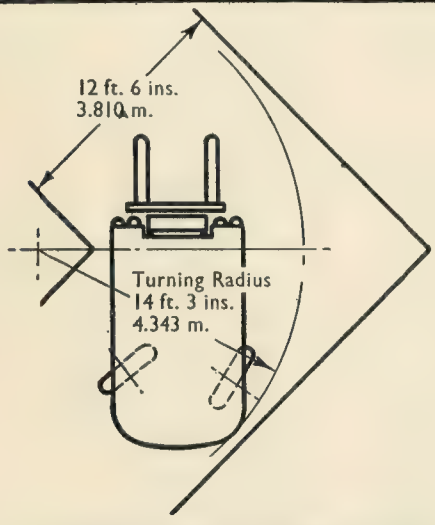
OVERALL WIDTH	WHEEL TRACK	
	Front	Rear
7ft. 1½ins. 2·172 metres	5ft. 5ins. 1·651 metres	5ft. 9ins. 1·753 metres



MAST HEIGHTS

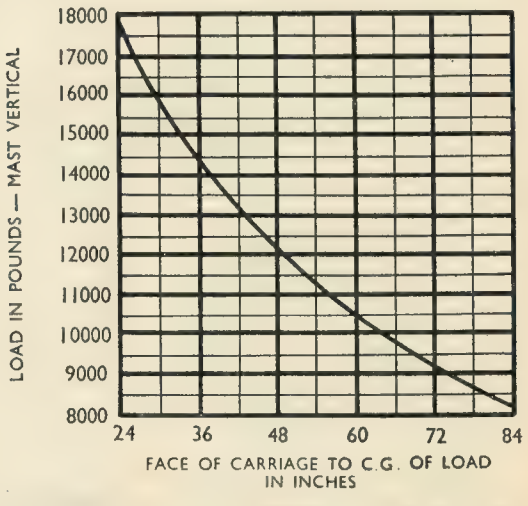
Lift	Retracted	Extended
12 ft.	10ft. 1in.	16ft. 1in.
3.658 m.	3.07 m.	4.90 m.
15 ft.	11ft. 7ins.	19ft. 1in.
4.572 m.	3.53 m.	5.82 m.
17ft. 6ins.	12ft. 10ins.	21ft. 7ins.
5.334 m.	3.91 m.	6.58 m.
20 ft.	14ft. 1in.	24ft. 1in.
6.096 m.	4.29 m	7.34 m.
and to Special Requirements		

WEIGHT	SPEED OF LIFT	MAXIMUM ROAD SPEED Forward and Reverse
Standard Truck fitted with 12ft. Lift Mast 9 Tons 2 Cwt. 9246 Kg.	35 Feet per Minute 10·7 Metres per Minute	22 Miles per Hour 35·4 Kilometres per Hour



TURNING CIRCLE DIAGRAM

RATING DIAGRAM



Dimensions and performance data

There is also a comparatively new kind of device which makes the lifting of batches of drums an easy matter. This consists of two flat jaws, operating as a kind of vice, and made to grip the load by means of hydraulic power.

Without attachments, the fork truck is of course used in conjunction with many different types of stillages and pallets, these being in effect containers, trays, hoppers, etc., so built that the forks of the truck can be inserted underneath them, to lift and carry them. Sometimes they have small wheels or castors, so that they can be pushed about when on the floor. Some are of wood, some of pressed steel or angle-iron.

To see fork trucks at work, lifting, transporting, stacking, etc., is quite an education, and on the model scale it would offer very wide possibilities, particularly if some form of remote control could be arranged.

The fork truck does not by any means exhaust the possibilities, however. There are many other interesting appliances. For instance, some of the ordinary industrial trucks are excellent subjects for copying in miniature.

A particular one which the writer has in mind is a three-wheeler with one wheel at the front. This single front wheel and steering unit is carried on a 14-in. turntable mounted and revolving on 72-$\frac{1}{2}$ in. steel balls, and carries the complete engine and transmission. It turns through 180 deg. and has tiller control. Obviously a full turn also gives reverse gear, in effect. The engine is a Villiers 98 c.c. four-stroke.

The truck has a simple angle and channel steel chassis, and flat, tipping and sided bodies, etc., can be interchanged.

The straddle truck is a comparatively new development. Basically, it consists of a large, low-built box-structure with two large wheels at the front and two much smaller ones at the rear. In action, the vehicle is driven over the load—i.e. straddles it—and then lifts it up by means of elevating hooks. The load can then be carried any distance. Obviously all wheels must be independently sprung and mounted, and are, in effect, on long "legs." Drive is by chain to the two front wheels, the engine and gearbox being high up, at driver-level. The engine is a normal type of six-cylinder compression-ignition unit.

Perhaps the best way to see industrial trucks and other specialised types at work, is to obtain permission to visit factories, plant yards, etc., and very few industrial concerns object to having interested visitors.

For the BOOKSHELF

The Locomotives of R. E. L. Maunsell, by O. S. Nock. (Bristol: Edward Everard Ltd.). 192 pages, 6$\frac{1}{2}$ in. by 9 in. Two coloured plates. Numerous illustrations. Price 17s. 6d.

It is fitting that the work of the late Mr. R. E. L. Maunsell, formerly chief mechanical engineer of the Southern Railway, should be assessed at its true value and placed on permanent record. In this book, Mr. Nock has achieved this desirable aim and, as might be expected, in a thoroughly competent and understanding manner.

The first chapter provides a glimpse of Maunsell's work as Locomotive Superintendent of the Great Southern and Western Railway of Ireland, and finishes with his transferring to a similar post at Ashford, on the South Eastern and Chatham Railway. The following eleven chapters are devoted to a detailed and progressive survey of locomotive designs, some of which did not progress beyond the drawing-board stage, for the S.E. & C.R. up to the year 1923, when Maunsell was appointed Chief Mechanical Engineer of the Southern Railway, a post that he held until 1937.

It was during the last-mentioned period, perhaps, that Maunsell did his best work, loyally supported by such men as R. Surtees, J. Clayton, H. Holcroft and T. S. Finlayson; for it is to this period that the "King Arthurs," "Lord Nelsons" and "Schools"—to name only three classes—properly belong. Each of the various classes of engines is examined in considerable detail, and there are many descriptions of performances in everyday traffic.

The illustrations are generally excellent and include diagrams of each class, as well as a general arrangement drawing of the *Lord Nelson* in the original condition. The two fine coloured plates depict, respectively, the "King Arthur" class engine No. 456, *Sir Galahad*, and a very interesting comparison between the mighty *Lord Nelson* and Stroudley's *Gladstone*. Among the diagrams, there are three "proposals," namely: a 4-cylinder 4-8-0 heavy mineral engine, a 4-cylinder 4-6-2 express passenger engine and a 3-cylinder 2-6-2 express engine, and one cannot help regretting that none of these was ever built.

It has long been felt that, for their size, the "Schools" class were an absolute masterpiece, and Mr. Nock provides more than enough evidence to substantiate the claim; his accounts of "Schools" performance prove that these engines must be placed firmly and irrevocably among the finest steam locomotives that have ever run in Britain.

This is a book that cannot fail to warm the hearts of all Southern enthusiasts and many others besides.

Successful Conjuring for Amateurs, by Norman Hunter, edited by F. J. Camm. (London: C. Arthur Pearson Ltd.). 383 pages, 5 in. by 7 in. Illustrated. Price 15s. net.

There are few mechanically-minded people who are not interested in the art of conjuring, either as fascinated spectators or as amateur exponents. At the same time, practically everybody knows that a conjurer's effects are produced by trickery of the kind that the late John Nevil Maskelyne used to describe as "pure, honest trickery"! But not everybody knows exactly how a conjurer produces his effects; conversely, the clever conjurer exerts his utmost endeavours to ensure that no one in his audience shall see the *modus operandi*.

In this book, Mr. Norman Hunter, for many years associated with Maskelyne's Mysteries, illustrates and describes, clearly and concisely, the methods employed in performing an innumerable selection of conjuring tricks, most of which require nothing very elaborate or costly in the way of apparatus. The construction of much of this apparatus is illustrated in the drawings, and is well within the capacity of the average home workshop.

There are something like 500 illustrations in line and halftone, to explain the working of effects which range from the simplest card trick to making a table rise into the air.

It is a book to be read for enjoyment as well as for instruction, and can be cordially recommended to anyone interested in the subject and wishing to find an out-of-the-ordinary job for his workshop.

Instruments for Drawing Curves

By A. Smith, A.M.I.E.D.

THE drawing of curves of various types and forms is a difficulty frequently encountered in the workshop. The drawings show some of the multitudinous contrivances which may be employed to form an accurate trace of the required curve.

In Fig. 1 is shown a Cyclograph, an apparatus for the describing of circular arcs, the chord and versed sine being given. Fix pins at *A* and *B*, fasten together two lengths of wood so that they pivot at *C*, and fix a pencil between them at *C*. Move the structure round, keeping it against the pins and an arc will be described.

Fig. 2 illustrates the principle of the Cycloidograph which is made use of to form hypo- or epi-cycloid curves. A modification of this is used to draw the curves of the teeth of gear wheels.

The Hyperbolagraph shown in Fig. 3 is a simple piece of apparatus which may be easily and quickly made for use in the drawing office or workshop when it may be desired to set out a curve of a hyperbolic nature. The arm is pivoted at *C*, the height *H* and the focus *A* being given. A length of thin string is fixed at *A*, goes up to *O* and back down the pivoted arm to be fixed at *B*. A pencil point is placed within the fold of the string at *O*, and, as the arm is pivoted about *C*, forms the trace which gives the required curve.

Fig. 4 is of a similar nature utilising a set-square and a straight-edge,

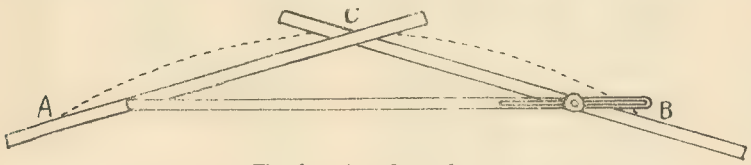


Fig. 1. A cyclograph

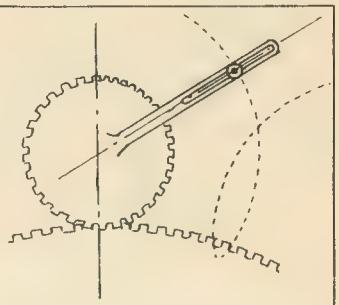


Fig. 2. The principle of the Cycloidograph

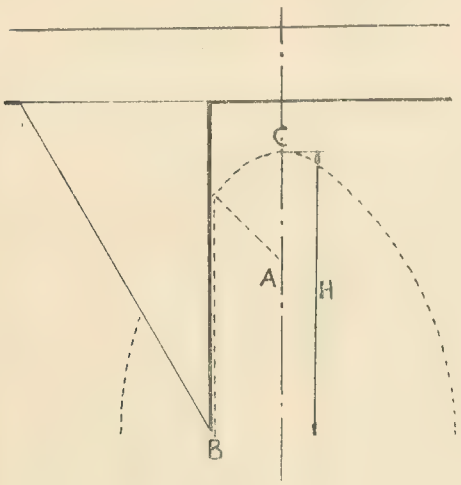


Fig. 4

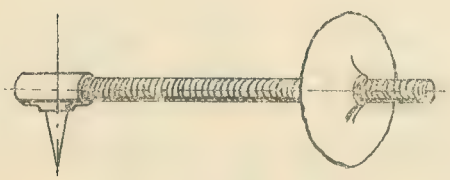


Fig. 5. An Helicograph

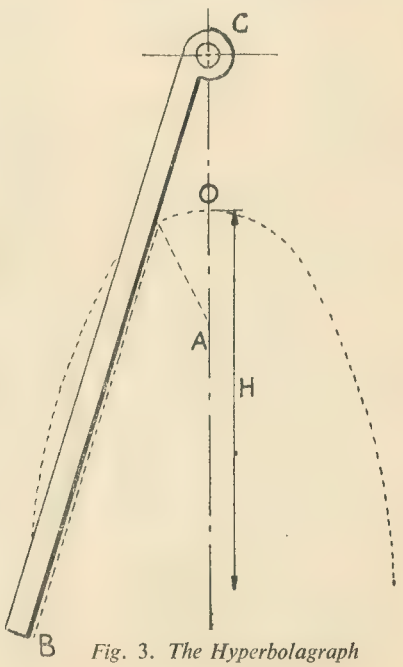
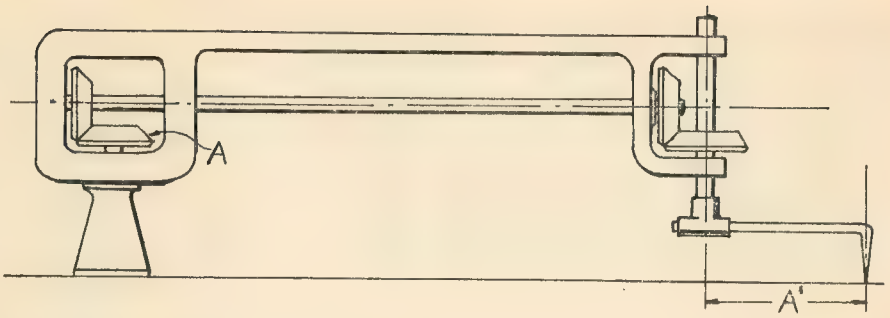
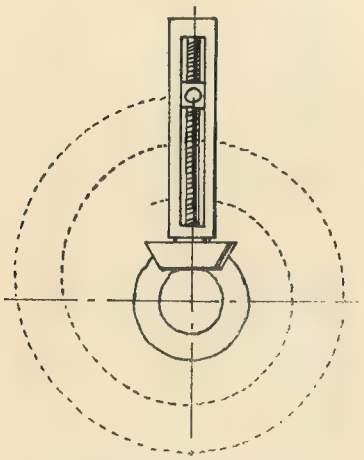


Fig. 3. The Hyperbolagraph

Right: *Fig.* 7. *Apparatus for drawing ellipses*



Below: *Fig.* 6. *Another Helicograph*



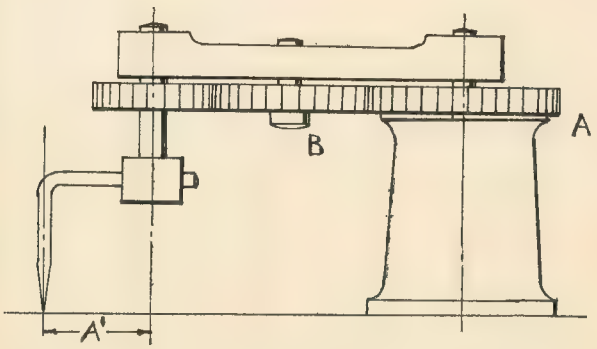


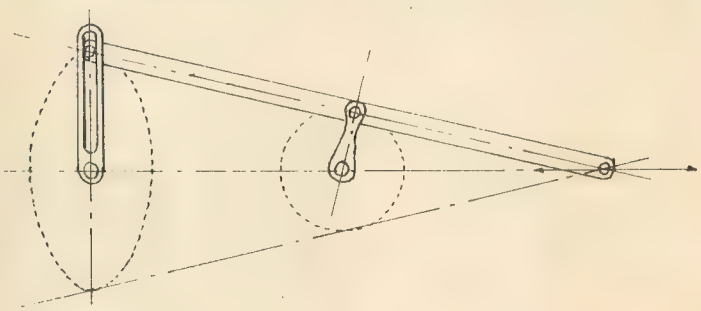
Fig. 8

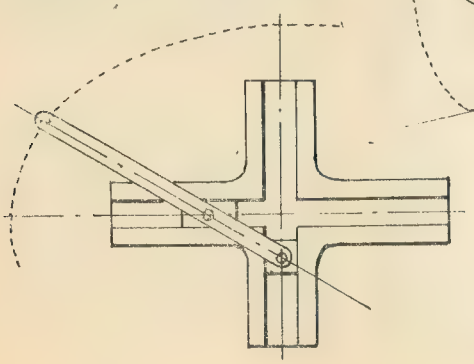
and traces out a parabolic curve.

Two Helicographs are shown in Figs. 5 and 6. The former consists of a radial screw and a roller nut, which travels along the screw as the apparatus is revolved on its centre pivot. The latter version is slightly more complicated, as a pen or pencil point is used to trace the helix. This scribing point is actuated by the radial screw driven by the two bevel gears.

Drawing Ellipses

Ellipses are drawn in a multitude of different ways. Two unusual methods are shown by Figs. 7 and 8. The bevel wheel *A* is fixed, the other three revolving with the whole machine about the fixed central standard. The distance A^1 is the difference between the major and minor axes of the ellipse. Fig. 8 performs the same operation in a similar way. The first gear is fixed and is of the same diameter as the second gear *B*. Third gear is half of the diameter of *A* and *B*.





Above: *Fig.* 10. *An elliptical crank*

Left: *Fig.* 9. *A common form of trammel or ellipsograph*

The common form of trammel or Ellipsograph is illustrated in Fig. 9. The tracing arm is pivoted to two blocks which are free to slide along the major and minor axes of the ellipse. Fig. 10 shows an elliptical crank, not the ideal thing to watch in motion if one is adicted to seasickness !

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

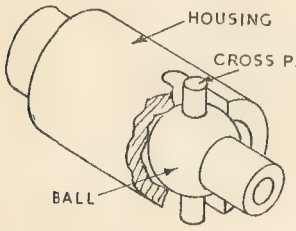
(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Propeller Shaft Coupling

I am installing a 2½ c.c. diesel engine in a model cruiser, but find that owing to the angle of the propeller shaft, the engine has to be stuck up at a very inconvenient position to enable the shafts to line up properly. Can I use a universal joint for the shaft coupling, to allow the engine to be mounted horizontally in the hull? What is the best form of universal joint to use, and where can I obtain one?

M.W. (Chester).

Wherever possible, it is advisable to avoid any drastic difference in the angles of the engine and the transmission shaft, because although it is true that a universal joint will enable the drive to be transmitted at a considerable angle, the work which is absorbed in flexing or articulating the joint must necessarily lower the mechanical efficiency. Generally speaking, the appropriate use of such joints is rather to accommodate accidental or incidental variation of alignment, such as may be caused by flexing or warping of the hull structure, rather than permanent angular difference. Many small



boats have the propeller shaft inclined at an unnecessarily steep angle, which not only makes it difficult to line up the engine properly but also produces a downward thrust at the stern of the boat, which affects running trim. The angles should only differ if it is absolutely necessary, but generally it is possible to plan the installation to give a very shallow propeller shaft angle, with little or no change of angle for the engine shaft. In any case, the shaft axes must coincide or intersect at the point where the joint is fitted. We do not know where to obtain a ready-made universal joint small enough for your purpose, but the simple ball and pin type of joint which is used with success in many model boats, is very easy to make and install, and is the most compact form of coupling which satisfies the required conditions.

Suppressor for Spark Coil

I have been using an induction coil for experimental work, but find that it causes a great deal of interference with neighbouring radio and television receivers. The coil is of the type having a vibrating contact-breaker, and gives about ½-in. spark. I have tried various forms of suppressors, including condensers in the primary circuit (the contacts already have large paper and tinfoil condensers across them), but any form of condenser or choke in the secondary circuit puts the coil out of action. Can you suggest a remedy?

H.H. (Carlisle).

Any kind of high-tension discharge, such as a spark gap, produces very powerful radiations, which are capable of upsetting radio reception over a wide area. It may be observed that the earliest forms of radio transmitters employed a spark coil to produce the signal, and as this form of radiation cannot be confined to a narrow wave band by tuning, it will affect any receiver within its range. No form of suppressor of which we have any knowledge would be effective, and as you suggest, any device connected in the secondary circuit would modify the discharge current and possibly quench the spark altogether. It might be possible to screen the radiation by putting the entire apparatus, including the spark gap, inside an earthed metal box, but even this could not be guaranteed as 100 per cent. effective.

Cable Ratings and Traction Motors

I have obtained an ex-W.D. transformer which is rated at 6 volts, 150 amps. For the L.T. leads, I am using a 15-way cable of 7 strands per cable, each strand being 0.0124 in. diameter copper, but this cable gets too hot to hold after 10 min. work using a graphitised carbon of ⅜ in. diameter. This leads me to think that the output must be a lot higher than the 150 amps stated. How could I arrive at the actual current?

I am contemplating using the above transformer to run an electric locomotive using one or two 6-volt car starter motors. Will this type of motor run on a.c., or would it be possible to rebuild them to do so?

W.A.B. (Ilford).

The current ratings of wires and cables is based on 1,000 amps per sq. in., and this current value is taken as the normal working current. Ratings above 1,000 amps are used for particular purposes, and in your case you could work a cable at a value over 1,000 amps. For a trailing cable used for welding and where the load is not continuous, ratings as high as 3 to 4 thousand amps may be used. A cable of 19 strands of 0.044 in diameter would at 1,000 amps carry approximately 53 amps, at 3,000 amps it would carry 159 amps and a cable of this size would be suitable to use. The current rating of the conductors you have in your cables is 0.1208 at 1,000 amps and the carrying capacity at this value is 12.6 amps only, working at 3,000 amps would only give a current of 37.8, and this fact accounts for the heating you are getting. Cables are made specially for welding use and we suggest that you contact any welding supply firm, who would offer you the most suitable cable if you explain the time period over which you propose to use it.

Car starter motors would not be suitable for use on an a.c. current. To operate on alternating current, the whole of the field system and the armature requires to be laminated. It would not be practical to rebuild the motors for a.c. use. You could, of course, provide a rectifier outfit for the d.c. supply, but not at 6 volts, the secondary volts of the transformer would have to be not less than about 18 volts as input to the rectifier.

READERS' LETTERS

● **Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.**

READY-PACKED LATHE TOOLS

DEAR SIR,—There have been a number of toolposts (adjustable) described in THE MODEL ENGINEER. Most of my turning has been done with two tools of $\frac{5}{16}$-in. body and six of $\frac{3}{8}$-in. body. So I made up a pack for each tool. On hand was a piece of $\frac{3}{8}$-in. × $\frac{3}{8}$-in. × 1/32-in. channel. The $\frac{5}{16}$-in. tools just fitted inside the channel and were built up to proper height with thin strips of brass inside the channel. The sides of the channel still stuck up enough to hold the tool in place. For the $\frac{3}{8}$-in. tools I used some $\frac{3}{8}$-in. angle and built to height the same way, adding an extra strip at the side and thus making a channel.

Some of these I soldered at the ends; for others, I used some so-called liquid solder, which is satisfactory, as there is no strain. The tools just lie loosely in the channel. If there is any reduction in tool edge height it is simple to add a piece of shim, and it is very easy to make up a new pack for a new tool. The tools, each with its pack, are on a shelf at the side of the lathe. The reason for using the channel is so that the tool will not slew about when being clamped in the toolpost. Each tool and pack is numbered, as I had the stamps.

To change a tool, it is only necessary to loosen the clamping-nut on the tool holder, take out the one tool, put in the new one, tighten the nut and start in work again without any adjustment of the tool height. An adjustable toolpost has to be adjusted each time.

Yours faithfully,

New York, U.S.A. BERTRAM R. WHITE.

ANOTHER "CYGNET" ENGINE

DEAR SIR,—Being at a loose end for something to make, I looked round and found Mr. Westbury's "Cygnet" filled the bill. But no kind friend gave *me* a nice piece of $\frac{7}{8}$ in. square dural to make the body from, though a friend had given me a large chunk of phosphor-bronze because he found it difficult to machine; it was all that—and then some! However, with a 6 in. × $\frac{1}{16}$ in. H.S. saw and my pet vertical-slide (illustrated by Mr. Westbury in his book *Mlling in the Lathe*), I soon had a piece the required size. Of course, no c.i. liners were required in my case, but for the rest of the machining I followed the instructions of the designer, all but cutting the ports, and the recess in the slide-cum-rotary-valve.

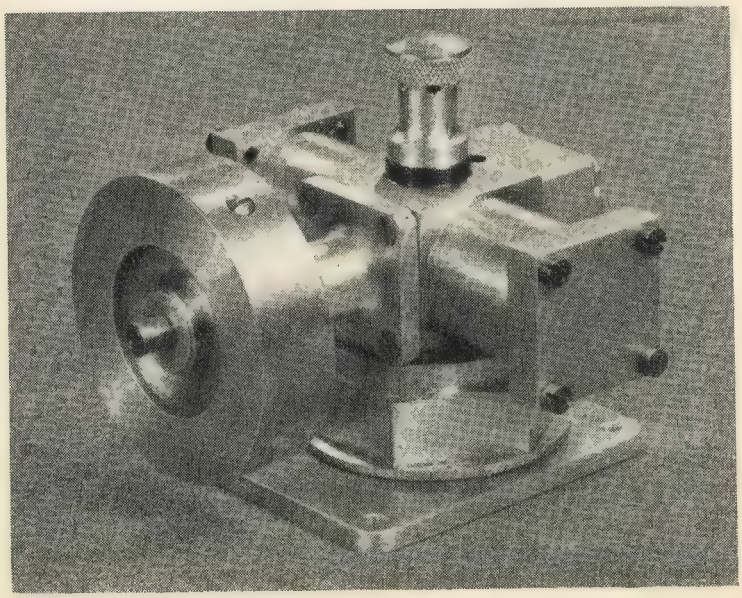
The ports were drilled as per instructions, but I did not think much of the "mouse-tail file" bit. So I machined up a cast-steel drift, the size of the ports, and drifted the intervening metal out. Work from the front side for about half way through, and then reverse. With a view to avoiding chipped port edges, do not drive the drift right through from the reverse side, but only half way. Then drive right through from the front side. You should then have two clean-cut bean-shaped ports.

Getting the recess in the rotary-valve means making a special tool in any case, and a bit of careful setting-up to get the diameters right. So I did the whole thing in one go. I put a short bit of $\frac{3}{8}$ in. silver-steel in a collet, centred it carefully, and drilled a $\frac{1}{16}$ in. hole about half-an-inch up. This hole was then opened out carefully to 5/32 in. for about an eighth of an inch up. A few teeth were filed on the face, and the thing hardened and tempered, making a plain, common, hollow-mill. A bit of $\frac{1}{16}$ in. silver-steel provided a pilot, but do not let this project far from the cutting face or it will foul the bottom of the hole in the valve. Pistons, in my case, were of dural, and I put a few grooves round them with a sharp, pointed graver.

After a short run on air, I dismantled it and eased the high places on the pistons with a worn, dead smooth file, and reassembled. I have no definite use for the engine, so have only tried it on air, but, considering its bore and stroke, it seems quite powerful on 20 lb. of air and will tick over slowly and evenly on a couple of pounds or so. Altogether a pleasing little thing to make. I may say that I used a slightly larger and heavier flywheel than the drawings show, and it seemed all to the good.

Yours faithfully,

Luton. ERNEST W. FRASER



Mr. E. W. Fraser's "Cygnet" engine

"AUSTERITY" 2-10-0 LOCOMOTIVES

DEAR SIR,—I was very interested to read the article on the "Decapods" and in particular the reference to the "Austerity 2-10-0.

Between July and November, 1944, I was serving in H.M.S. *Daffodil* (alas, now lying on the bed of the channel), the official nomenclature of which was "L.S.S." (i.e. Landing Ship, Sternchute), but which, in fact, was the ex-trainferry *Royal Daffodil*. In May, 1941 she was converted to a landing ship to carry smaller landing craft, and between May, 1944, and July, 1944 was again modified to accommodate trains.

Immediately Cherbourg Harbour was re-opened in July, 1944, she commenced to ferry rolling-stock for Army use. As the Army moved eastwards and Dieppe became open to traffic again, the shuttle service between Southampton and Cherbourg was shifted to Southampton-Dieppe. During the comparatively short time in which I served in *Daffodil* she made 10 such trips to Cherbourg and 15 to Dieppe, averaging some 750 tons of rolling-stock per trip.

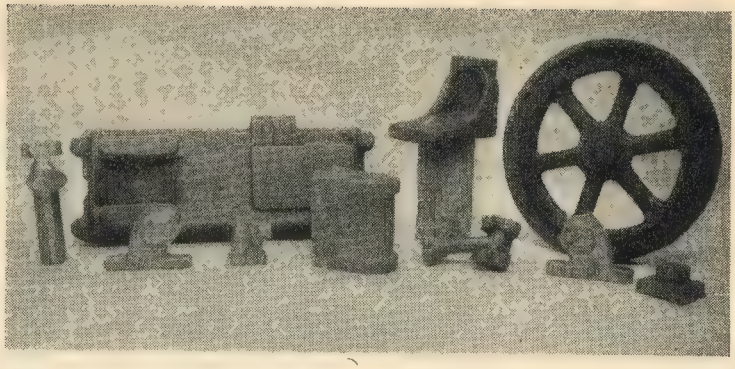
For the first five of these trips we ferried American freight locomotives (second-hand) of a type with which I am not familiar. I do remember, however, that they were heavy and cumbersome, and considering that they had to be man-handled into position on the operations deck, they were instrumental in adding a few more phrases of railroad Esperanto to "L.B.S.C.'s" dictionary. Thereafter, these were displaced by "Austerity" 2-10-0s and 2-8-0s, principally the former, and it was very significant to note on the 7th or 8th trip to Cherbourg that the American locomotives already ferried were still standing on the quayside, almost derelict. The American Forces were in occupation at Cherbourg, and as soon as the British "Austerities" appeared they cast their own aside in preference to the "Austerities."

The matelots of *Daffodil* rejoiced at the advent of the "Austerities," as they were much easier to handle than the American types. The secret lay in the fact that in the case of the "Austerities" the connecting-rod was removed prior to our taking them over, and two men could easily move a 2-10-0 about the operations deck, even though the deck rose in a slight incline towards the traversing gear for'ard.

When I read the article it occurred to me that I seemed to remember seeing the plate of "North British" on the "Austerities," although after this lapse of time I could not be dogmatic about it. But it was satisfying to be reassured by the "Smoke Ring" in the issue of March 11th, last.

From the reports received at both Cherbourg and Dieppe, it was quite evident that the "Austerities" served a very useful purpose so far as war-time operations were concerned.

Yours faithfully,
Bradford. A. WILD.



A MICROSCOPE FROM THE JUNKBOX

DEAR SIR,—In the article which appeared in the March 4th issue of THE MODEL ENGINEER on the above subject, two small errors appeared.

The letter "E" drill for the tapping diameter of the $\frac{1}{4}$-in. B.S.F. thread should have read 0.205 in., not 0.025 in. and the thickness of the brass support plates $\frac{1}{16}$ in. and not $\frac{5}{16}$ in.

Yours faithfully,
Chadwell Heath. W. J. BROWN.

A CLUB TEAM EFFORT

DEAR SIR,—The photograph reproduced above shows some castings and patterns that have been made by members of The Barnsley & District Society of Model Engineers for the "Unicorn" engine, as described in the articles on "Utility Steam Engines in THE MODEL ENGINEER.

The base and flywheel castings, also the cylinder bracket, are of cast-iron, the others are of bronze.

It is doubtful if we shall see a completed engine this year, out of the dozen that the club members are attempting, owing to other commitments, but we live in hopes.

I myself am making a four-jaw independent chuck; I have a smaller one that I made about six years ago, and is still going strong, although I never got round to hardening the jaws. The type I am making follows the design of one that was made by a firm under the name of "Malco" or "Alco" some twenty-five years ago. The jaw is held to a slot in the body plate by a nut at the back; a screw in the slot passes through the square portion of the bolt and is operated by a key through a hole in the edge of the body plate. "L.B.S.C." mentioned a three-jaw independent chuck a week or two ago. Is it one he made, and would it be a good substitute for a collet chuck? I should like him to enlarge on the subject if that is possible.

Yours faithfully,
Barnsley. J. ROMANS.

LENS CALCULATIONS

DEAR SIR,—In his article on "A Microscope from the Junk-box" (4/3/54), Mr. Brown quite correctly says that the distance at which a convex lens gives a sharp image of a source a few feet away is approximately the focal length of the lens, i.e., the distance at which parallel rays reaching the lens are brought to a focus. In order to get the true focal length, add the reciprocals of the two distances source-to-lens and lens-to-image, and take the reciprocal of the sum. Thus, if the light is three feet from the lens and sharp image one foot from it, add 1/3 to 1/1 = 4/3, whence the reciprocal, 3/4 foot or nine inches, is the focal length of the lens. The shorter the focal length (i.e., the more powerful the lens), the nearer is the focal length to the distance of the image of a source at several feet. Thus: Distance of source 36 in.; distance of image 1 in. : 1/36 + 1/1 = 37/36; focal length is 36/37 in. The simplest way of getting the true focal length is to find the distance that the lens must be held from a screen or wall to get a sharp image of a source at "infinite" distance, such as the sun or moon; in practice, anything more than 20 ft. away may be regarded as infinitely distant for this purpose. The distance lens-to-screen is then the true focal length.

Yours faithfully,
Edinburgh. G. STRUAN MARSHALL.

WITH THE CLUBS

International Radio Controlled Models Society

The Coventry Radio Controlled Models Club has now become the Coventry Group of the I.R.C.M.S. (thus making five I.R C.M.S. groups in all, the others being in London, Birmingham, Manchester and Tyneside). The secretary of the new group is MR. P. HASELOCK, 25, Wainbody Avenue, Coventry, Warwicks. Meetings will continue to be held at the Allied Airmen's Services Club, 78, Holyhead Road, Coventry, on the first Wednesday of each month, at 8 p.m.

Hon. Secretary: C. H. LINDSEY, 55, Tenison Road, Cambridge.

Darlington S.M.E.

At the recent third annual supper of the society, our president, Mr. R. L. Clarke, presented the club's challenge trophy and replica to Mr. W. R. Mallows, who, as a newcomer, has set the rest of the lads a stiff pace in craftsmanship.

The club activities for the ensuing year are: a 5-in. gauge "Speedy" as a club locomotive; visits to various works in the locality, and film shows of a technical nature by Mr. C. Richardson.

Our meetings are now held on alternate Thursday nights, at 7.0 o'clock in Mr. C. Richardson's cafe in Skinnergate, (side door).

Now, local lone hands, what about joining the club? You will be welcome.

Hon. Secretary: N. W. THORNTON, 60, Witton Crescent, Darlington.

The Tonbridge and District Model Railway Club

At the annual general meeting it was agreed that the club room be available to members on the first, second, third, and fifth (if applicable) Thursday of each month, plus the usual fourth Friday.

Support in principle for the "Society for the Reinvigoration of Unrenumerative Branch lines of the U.K." (S.R.U.B.U.K.), with particular regard to the K. & E.S. Railway, was unanimously agreed to.

New members and visitors are always welcome, or, write to the Hon. Secretary: A. C. GALE, 185, High Street, Tonbridge.

St. Mellons Model Engineer Club

The club has had another very successful year of activity. The average weekly meetings usually mustered 15 to 20 members plus a few friends. During the early part of the year the members constructed a light portable track 150 ft. in length, for use at fetes and garden parties. During the summer five fetes were attended as entertainment for the youngsters, and it is estimated that well over 10,000 children were given free rides.

The members spent a very enjoyable day at Birmingham by the kind invitation of the Birmingham Society of Model Engineers; quite a few of our members taking their locomotives with them, and many pleasant hours were spent running on this large track. We are glad to announce that our membership is increasing, the fleet of locomotives is growing and the name of the club is becoming well known over a large area of South Wales and Monmouthshire

We are opening the track for the coming season on April 17th, when we will be pleased to welcome anyone who has a 3½" gauge locomotive to try it out. The track is situated on the main Newport-Cardiff Road, at St. Mellons, Mon.

Hon. Secretary: A. H. BREADY, 117, Alma Street, Newport, Mon.

Croydon S.M.E.

On March 11th, at the clubroom, 1, Daffas Hill, Croydon, we had a full evening's film show dealing with transport in all its phases, even the inland waterways, which the railways had tried to kill.

A point of interest to marine people is that the "Narrow Boats" would not only make interesting models, but straight runners for competitions as well.

It has been noticed that the "OO"-gauge section is coming out of its enforced hibernation, as the club track has commenced to grow again.

Hon. Secretary: R. F. WILSON, 24, Marden Crescent, Croydon, Surrey.

Watford Model Engineering Society

A full programme of events has been arranged for the next 12 months, including lectures and film shows. It is also probable that visits will be paid to three manufacturing concerns in the vicinity during the summer, and the support of all members is earnestly requested.

The Chipperfield track will be in operation for the first time this season on Sunday, May 2nd, and it is hoped that members are working overtime on those locomotives now in the "erecting shops," so that we can be sure of continuous running.

Hon. Secretary: W. J. DOWNS, 4, Malvern Way, Croxley Green, Herts.

Leeds S.M..E.E.

March 16th was "Tool and Gadget Night," winners were E. Drabweel, filing jig; A. Ellis, lathe mandrel.

Our exhibition will be held at the Corn Exchange, April 22nd-24th. In addition to the usual prizes, a special Leeds Trophy is offered for the best working steam model in the exhibition, and is open to all.

Hon. Secretary: E. MANN, 162, Town Street, Armley, Leeds, 12.

THE MODEL ENGINEER DIARY

April 22nd, 23rd and 24th.—Leeds Society of Model and Experimental Engineers.—Exhibition at the Corn Exchange, Leeds.

April 22nd, 23rd and 24th.—East Grinstead & District Model and Experimental Engineering Society.—Exhibition at the Sackville Canteen, De La Warre Road, East Grinstead. Open from 3-9 p.m. on April 22nd and 23rd, and from 10 a.m. to 9 p.m. on April 24th.

July 10th and 11th.—International Radio Controlled Models Society. Annual Contests for radio controlled models, to be held in Birmingham.—Model Boats on July 10th, and Model Aircraft on July 11th.

August 18th, 19th, 20th, 21st, 23rd, 24th, 25th, 26th, 27th and 28th.—THE MODEL ENGINEER Exhibition, at the New Horticultural Hall, Greycoat Street, Westminster, S.W.1. Open from 11 a.m. to 9 p.m.

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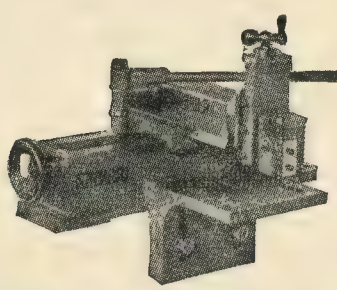

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Rebuild Lathes. The Acorn Machine Tool Co. (1936) Ltd., offer rebuilds to limits "Acorntools" and "Atlas" 10" swing s.s. and s.c. lathes. Hire purchase terms are available. Write—610-614, Chiswick High Road, W.4. (Phone: CHI 3416).

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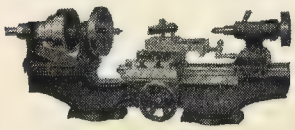

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L.N.E.R. B.1 Locomotive, 3½" gauge, 4-6-0 tender completed, chassis practically complete, including steam brakes, smokebox etc. Only needs boiler. Complete with all materials to finish, £65.—I. HAWKINS, 63, Hill Top Road, Paddock, Huddersfield.

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Low Voltage Power Units giving switched d c outputs of 12, 16, 18 and 24 V at 2 A. Will run ex-Govt. motors, charge batteries, operate model railways, from 110/230/250 V a.c. mains. Size 7" × 6". Original cost £6. My price 52s. 6d., post free.—G. MOLDON, 12, Upham Park Road., London, W.4.

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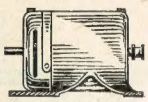

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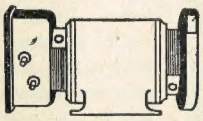

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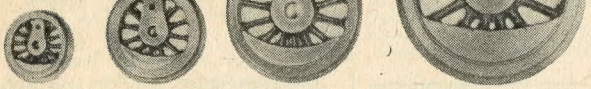

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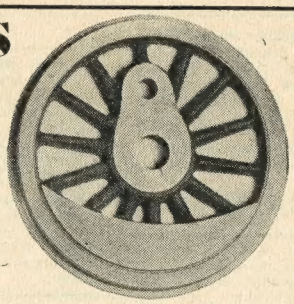

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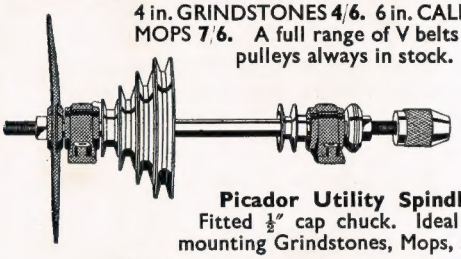

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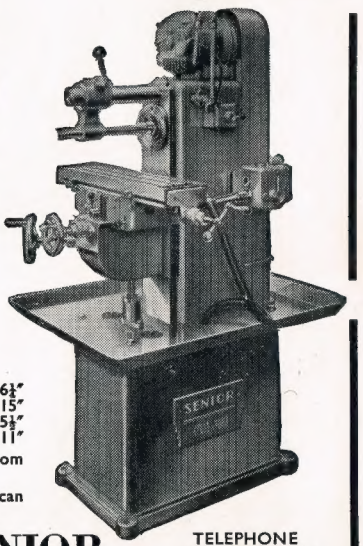

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